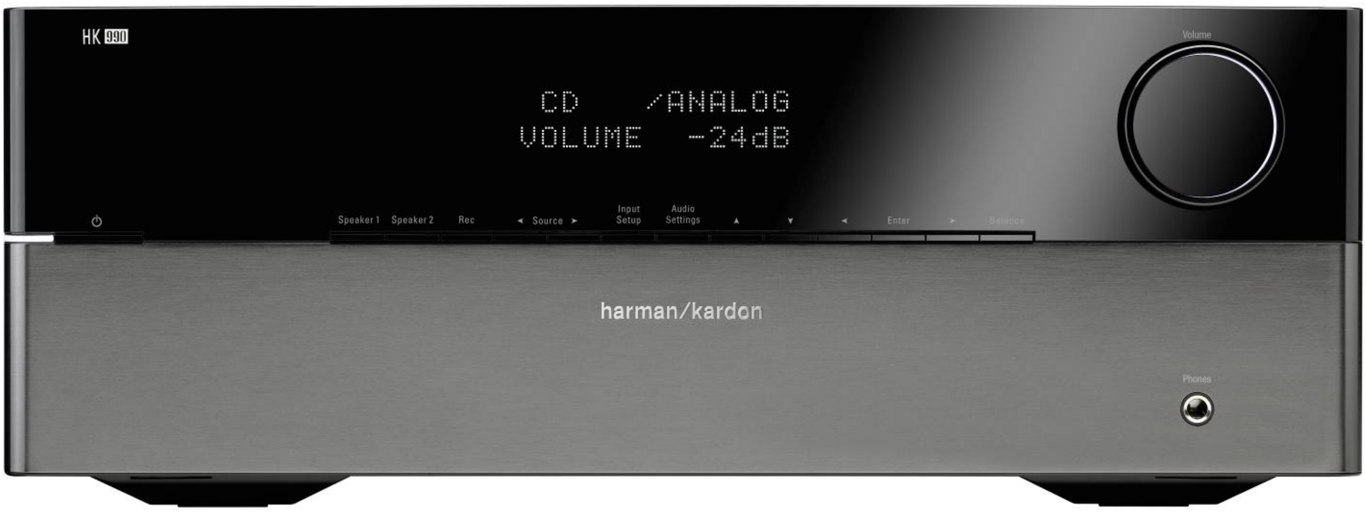
harman/kardon Service Manual

HK 990/230

2 x 200W INTEGRATED STEREO AMPLIFIER



Released EU2009

harman/kardon, Inc.
250 Crossways Park Dr.
Woodbury, New York, 11797

Rev 0, 03/2009

CONTENTS

Specifications

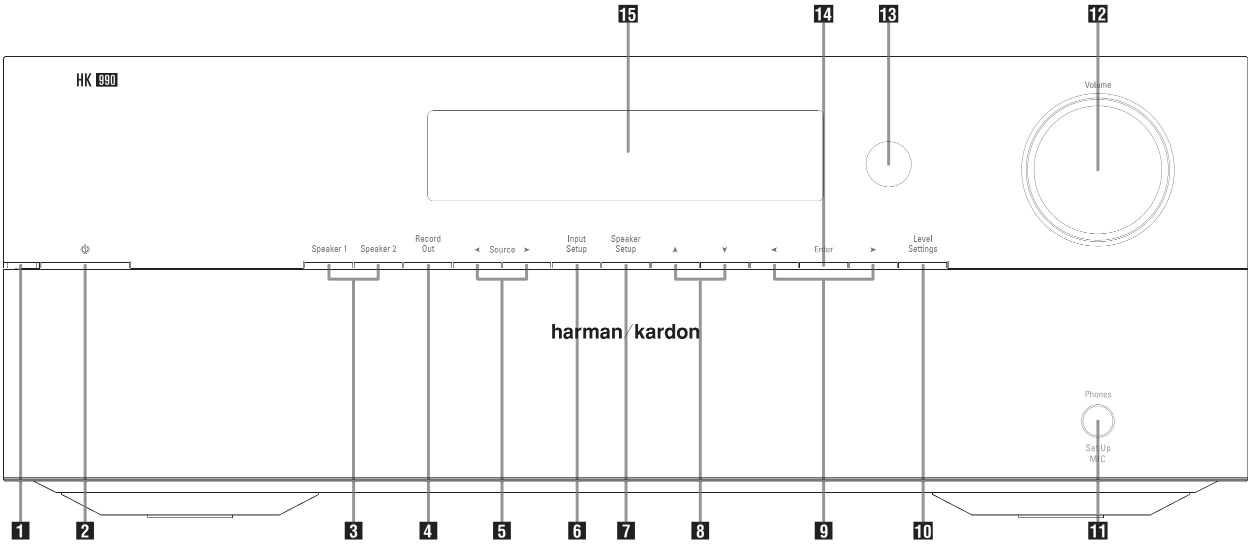
		NOMINAL
Continuous Average Power Per Channel (FTC)	8 Ohms:	150 Watts@<0.03%THD
20 Hz – 20 kHz, both channels driven	4 Ohms:	300 Watts@<0.3%THD
Dynamic Power (IHF, 1 kHz Tone Burst)	8 Ohms:	220 Watts
	4 Ohms:	440 Watts
High instantaneous current capability (HCC)		±200 Amps
Power Bandwidth @ Half-Rated output, 8Ω		20 Hz - 100 kHz
Frequency response @ 1W (+0/-3dB)		5 Hz - 120 kHz
Damping factor (20Hz-20k Hz)		>200
Signal-to-noise Ratio (Reference rated power output, A-WTD)	Tuner/CD	100 dB
	Phono (MC):	75 dB
Input sensitivity/Impedance	Tuner/CD	350 mV/43k Ohms
	Phono (MM):	10 mV/47k Ohms
	Phono (MC):	1 mV/100 Ohms
Overload	Tuner/CD	2.8V
	Phono (MM):	85 mV
	Phono (MC):	8.5 mV
Tone control range, Bass @ 100 Hz/Treble @ 10 kHz		±10 dB/±10 dB
Power supply		AC 230V, 50 Hz
Power consumption		1000 W
Standby power consumption		1W
Dimensions (Width x Height x Depth)		440 x 160 x 444 mm
Depth includes Volume Button and Loudspeaker Terminals		
Weight		24 kg

harman/kardon

A Harman International® Company
250 Crossways Park Drive, Woodbury, New York 11797
www.harmankardon.com
Harman Consumer Group International:
2, Route de Tours, 72500 Château-du-Loir, France

Part no. 8509 9012 0000

Controls and Functions



1 Power Indicator: This LED will illuminate in amber when the unit is in the Standby mode to signal that the unit is ready to be turned on. When the unit is in operation, the indicator will turn white.

2 System Power Control: Press this button to turn on the HK 990; press it again to turn the unit off (to Standby). Entering Standby also saves all Setup parameters.

3 Speaker 1/2 Selectors: Press to select speaker pair 1 or 2, or both, or neither (headphone output only).

4 Record Out Selector: First press shows the record source presently selected in the display. Pressing on the the Source selectors 5 within a few seconds after pressing 4 changes the record source. Exit this function by pressing 4 again, or wait for a few seconds until exit takes place automatically.

5 Input Source Selector: Select input source for listening by pressing one of the "Source" buttons repeatedly to scroll through all the Inputs either forwards or backwards, until the display shows the desired source.

6 Input Setup Button: Press this Button to enter/exit the Input Setup Mode. Here you can select the physical connection for each source (Analog/Digital etc.) as well as Gain, Bass/Treble etc. Refer to the Setup section of this manual.

7 Speaker Setup Selector: Press this Button to enter the Speaker Setup Menu, where you can switch subwoofers on and off, select crossover frequency, run automatic speaker setup (EzSet/EQ) etc. Refer to the Setup section of this manual.

8 Up/Down Arrow Buttons: Press to scroll through various options for adjustment in a menu.

9 Left/Right Arrow Buttons: Press to increase/decrease a parameter or to select between parameters after selecting a menu for adjustment with the Up/Down Arrow Buttons.

10 Level Settings Button: Press to enter/exit the Balance left/right adjustment for the speakers as well as subwoofer level.

11 Headphone Jack/Setup Microphone Input: Plug in headphones if desired. With both "Speaker 1" and "2" selectors in the Off position, output is supplied only to headphones. When using the automatic loudspeaker setup and calibration system (EzSet/EQ), plug the microphone in here.

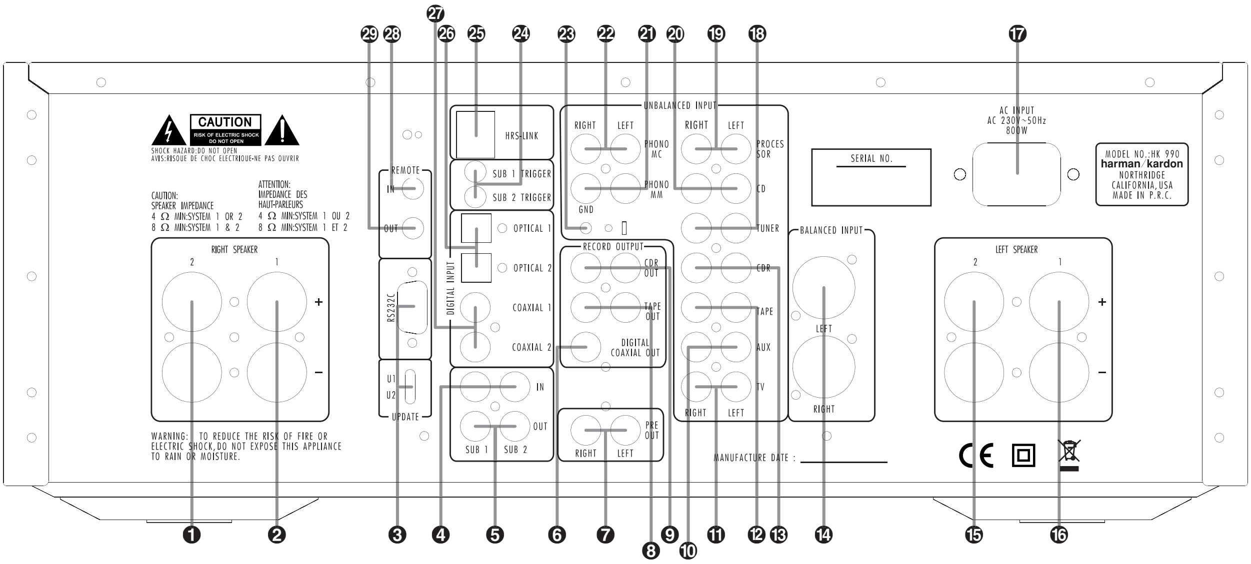
12 Volume Control: Turn to raise or lower output volume.

13 Remote Sensor Window: The sensor behind this window receives infrared signals from the remote control. Aim the remote at this area and do not block or cover it unless an external remote sensor is installed.

14 Enter Button: Press to select a parameter for adjustment and to confirm.

15 Main Information Display: This display delivers messages and status indications to help you operate the amplifier.

Connections



1 Right Loudspeaker output, System 2.

2 Right Loudspeaker output, System 1.

3 RS-232 connector for possible future PC update. Update Switch.

4 Input jacks for one or two subwoofer signals from external surround processor.

5 Output jacks for two subwoofers.

6 Digital coaxial output jack for digital recording. Also permits digital recording of analog sources.

7 Preamplifier output jacks.

8 Analog output jacks for tape recording.

9 Analog output jacks for CD Recorder analog recording.

10 AUX input jacks, suitable for analog signals from video games, video recorders etc.

11 TV input jacks for analog sound input from your TV.

12 TAPE input jacks for analog tape replay.

13 CDR input jacks, for CD Recorder analog replay.

14 Balanced analog inputs (XLR), for use with all signal sources that output balanced signals. Available via the CD Input function only, as an alternative to the unbalanced RCA jacks (Input 20). Pin configuration for the XLR Inputs: Pin 1 is Ground, Pin 2 is Plus/Hot, Pin 3 is Minus/Cold.

15 Left Loudspeaker output, System 2.

16 Left Loudspeaker output, System 1.

17 Power lead AC input.

18 TUNER analog Input jacks.

19 PROCESSOR Analog Inputs. These Inputs go directly to the power amplifier section of the HK 990, bypassing the Volume and Tone Control. Here you can connect the Front Channel Pre Out L+R signals from an external surround processor, to benefit from the superior power of the HK 990 and control volume from the processor. **NOTE**: Only use the Processor Input with a device that has its own volume control!

20 CD analog Input jacks. You can select either this Input or the Balanced Input as analog Input in the CD Input Setup Mode.

21 Phono Input for record player with Moving Magnet (high output and high impedance) or High-Output Moving Coil cartridge.

22 Phono Input for record player with Moving Coil (low output and low impedance) cartridge.

23 If your record player has a separate Ground wire, attach it here to avoid hum noise.

24 Connect the trigger Input (if available) on one or two subwoofers to these trigger ON/OFF output jacks. When you switch ON the HK 990, it sends a trigger signal, which switches ON the subwoofer. When switching OFF the HK 990, the subwoofer also switches OFF.

25 HRS (High-Resolution Synchronization) Input. Use the included HRS-cable to connect the HD 990 CD player (or other similarly equipped player) for optimum sound quality.

26 Optical Digital Inputs (TOS-Link). Connect any digital device with Optical Digital Output to one of these Inputs. Push the Optical Jack through the hinged door that covers the Input until it clicks into place.

27 Coaxial Digital Inputs. Connect any digital device with Coaxial Digital Output to one of these Inputs. Usually, Coaxial Digital transmission is preferred to Optical, given a choice.

28 Remote IN. To control your HK 990 with an external infrared remote sensor, connect the wire from the remote sensor here.

29 Remote OUT. Connect other Harman Kardon devices (you may also experiment with other brands) that you wish to control with the HK 990 Remote Control to this Output.

Band: Switches between frequency bands on a Tuner.

FM Mode: Switches between Stereo and Mono on a Tuner.

Auto: Switches between Automatic and Manual tuning on a Tuner.

Mem: For memorizing a radio station in the Preset Memory of a Tuner.

Clear: Clears the memory of a CD/CDR or clears a preset from Tuner station list.

Check: Press this button to check the order of tracks programmed into a CD player's memory.

Prog: Press this button to begin the process of programming a CD player to play the tracks of a disc in a specific order.

Speaker Setup: Press to enter the HK 990 Speaker Setup functions. See below for explanation of the Speaker Setup process.

Input Setup: Press to enter the HK 990 Input Setup functions. See below for explanation of the Input Setup process.

Arrow Buttons (> < ∧∨): This round button is used to navigate within the menus of the HK 990.

EQ Preset: Press to enter the HK 990 Equalizer Preset functions. See below for explanation of the EQ Presets.

Level Settings: Press to enter the HK 990 Level Setting functions. See below for explanation of the Level Setting process.

Enter: Press to confirm a selection within a HK 990 setup procedure or to switch between selections. See under each Setup process for further explanations.

Scroll +/–: When listening to a Tuner, press + to tune to higher frequency stations and – to tune to lower frequency stations. Also see the Owners Manual for your harman/kardon tuner.

Volume +/–: Press to adjust the HK 990 volume up or down.

Select: When listening to a tuner, press this button to alternate between Auto Tune, Manual Tune or Preset Tune.

Pause: When playing a CD, press this button to momentarily pause the disc. Press again to resume play.



Mute: Press this button to momentarily silence the HK 990. "Muted" flashes in the front panel display. Press again to re-activate sound output.

≪ and ≫ (Search Buttons): Press one of these buttons to search fast forward or backward on a CD or Tape. You can hear intermittent sounds from the CD while searching. Normal playback resumes when you release the button.

|≪ and ≫| (Skip Buttons): Press one of these buttons to move to the next track or to the previous track on a CD or Tape. Repeatedly pressing one of the buttons skips more tracks. On a CD, pressing Skip Forward while playing the last track skips to track 1, and pressing Skip Back while playing track 1 skips to the last track.

Stop: Press this button to stop play of a CD or Tape.

Play: Press this button to start playback of a CD or Tape. If the CD drawer is open, the drawer closes and play begins. Pressing the Play Button again pauses play momentarily, same as the Pause Button.

+10 and –10: When playing a CD, press the +10 Button to skip 10 tracks forward and the -10 Button to skip 10 tracks backward from the track you are playing. More presses again skips 10 more tracks. If there are less than 10 tracks to the end or start of the CD, the last or first track is played.

Folder + and Folder – : When playing a CD with MP3 files, these buttons move to the next or the previous folder with MP3 material.

Repeat: When playing a CD, pressing this button once repeats the current track, shown as "Rep 1" in the CD player's display. Pressing once more repeats the entire CD, shown as "Rep All" in the CD player's display. Third press exits repeat play.

Repeat A-B: When playing a CD, press once to establish a starting point (shown as "Rep A" in the CD player's display) and a second time to establish an end point (shown as Rep A-B in the CD player's display). The music between these two points is repeated as a loop until you press the button a third time, returning to normal play.

Open/Close: Opens the CD drawer when it is closed and closes it when it is open. The drawer may also be closed by pressing Play.

Random: When playing a CD, press this button to play all tracks in random order.

AMP Adjustment

Iding Adjustment

Precaution for handling measuring instrument

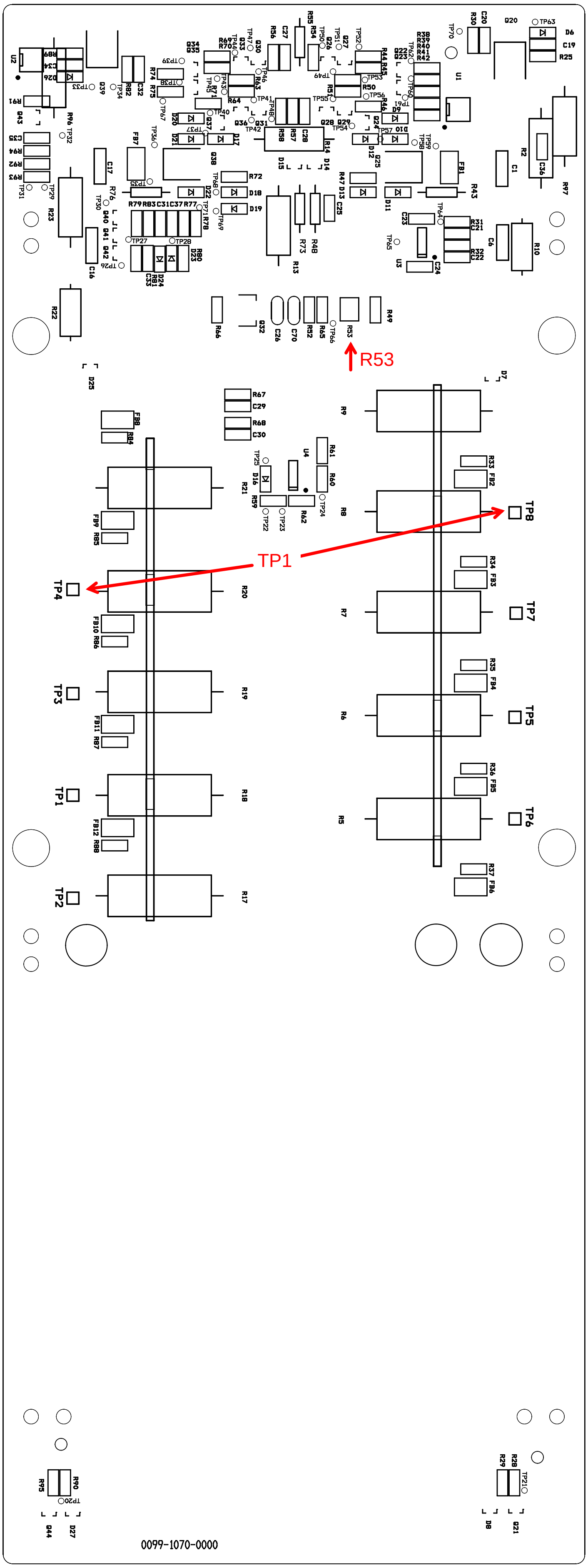
The ground side of the measuring instrument to be connected to the speaker terminal of this unit must be kept in floating condition because this unit is equiped with the floating balanced power amplifier.

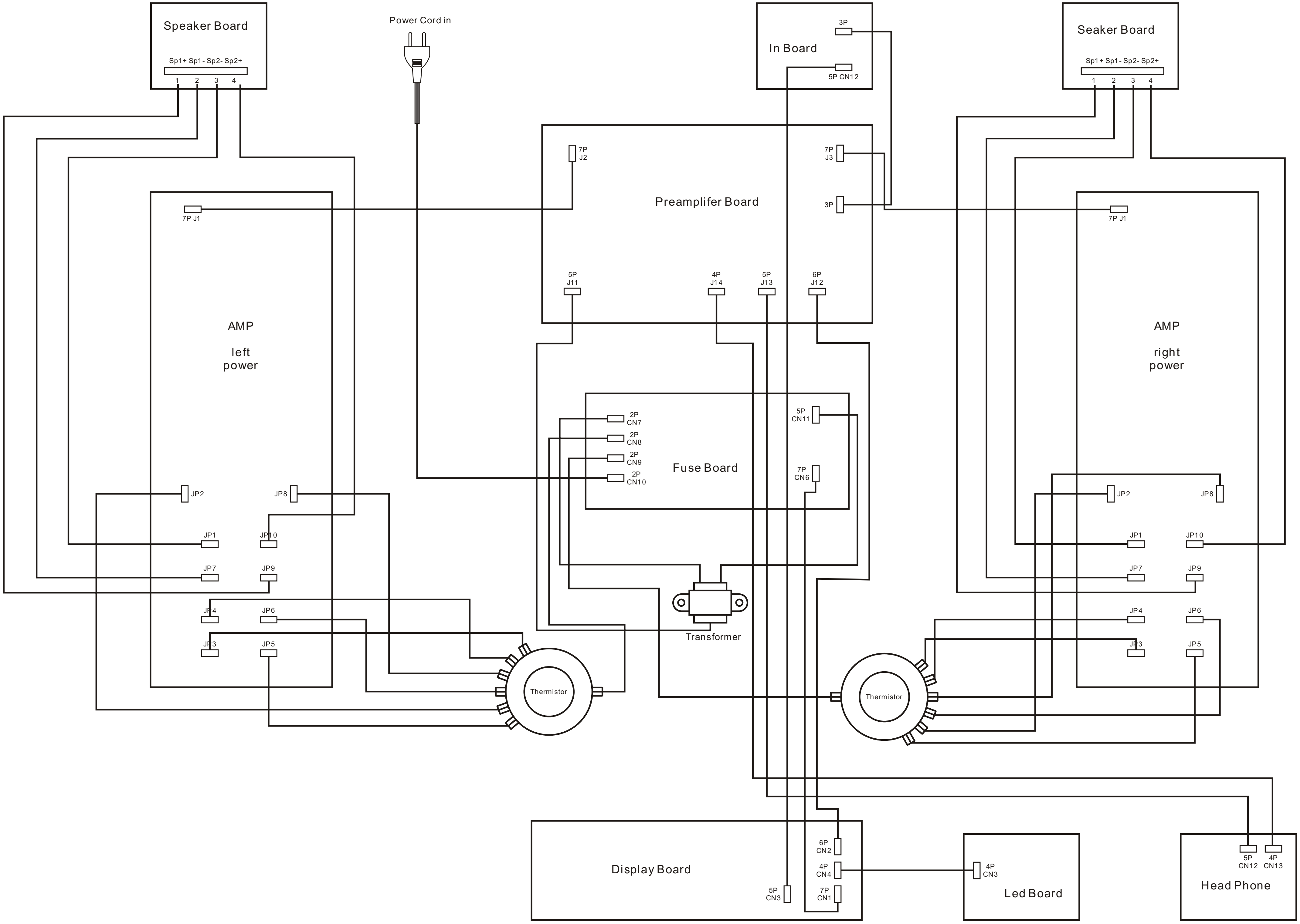
Condition

* Start adjustment 5 minutes or more after the power is turned on.
* Non loaded condition.

Idling Adjustment

Adjust R53 so that the DC voltage of TP1 becomes +38mV .




Speaker Board
Sp1+ Sp1- Sp2- Sp2+
1 2 3 4
Power Cord in
In Board
3P
5P CN12
Seaker Board
Sp1+ Sp1- Sp2- Sp2+
1 2 3 4
7P J2
7P J3
Preamplifer Board
3P
7P J1
7P J1
5P J11
4P J14
5P J13
6P J12
AMP
left
power
AMP
right
power
2P CN7
2P CN8
2P CN9
2P CN10
Fuse Board
5P CN11
7P CN6
JP2
JP8
JP1
JP10
JP7
JP9
JP4
JP6
JP3
JP5
JP2
JP8
JP1
JP10
JP7
JP9
JP4
JP6
JP3
JP5
Transformer
Thermistor
Thermistor
Display Board
6P CN2
4P CN4
7P CN1
5P CN3
4P CN3
Led Board
5P CN12
4P CN13
Head Phone

High Performance Multibit Σ-Δ DAC with SACD Playback

AD1955ARS

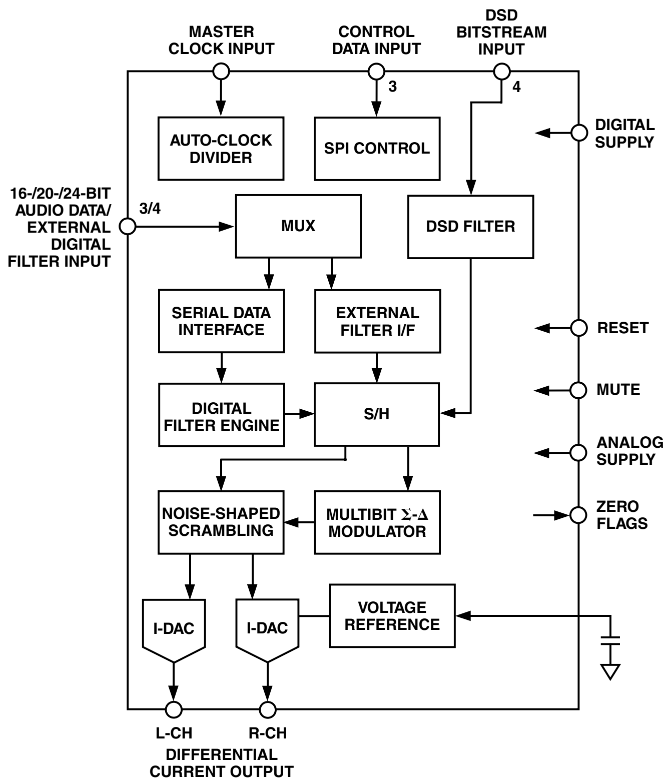
FEATURES

- 5 V Power Supply Stereo Audio DAC System
- Accepts 16-/18-/20-/24-Bit Data
- Supports 24-Bit, 192 kHz Sample Rate PCM Audio Data
- Supports SACD Bit Stream and External Digital Filter Interface
- Accepts a Wide Range of PCM Sample Rates Including: 32 kHz, 44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz, and 192 kHz
- Multibit Sigma-Delta Modulator with "Perfect Differential Linearity Restoration" for Reduced Idle Tones and Noise Floor
- Data Directed Scrambling DAC—Low Sensitivity to Jitter
- Supports SACD Playback with "Bit Expansion" Filter
- Differential Current Output for Optimum Performance
- 8.64 mA p-p Differential Output
- 120 dB SNR/DNR (not muted) at 48 kHz Sample Rate (A-Weighted Stereo)
- 123 dB SNR/DNR (Mono)
- –110 dB THD + N
- 110 dB Stop-Band Attenuation with ±0.0002 dB Pass-Band Ripple
- 8× Oversampling Digital Filter
- On-Chip Clickless Volume Control
- Supports SACD-Mute Pattern Detection
- Supports 64 f_S/128 f_S DSD SACD with Phase Mode
- Internal Digital Filter Pass-Through for External Filter
- Master Clock: 256 f_S, 512 f_S, 768 f_S
- Hardware and Software Controllable Clickless Mute
- Serial (SPI) Control for Serial Mode, Number of Bits, Sample Rate, Volume, Mute, De-Emphasis, Mono Mode
- Digital De-Emphasis for 32 kHz, 44.1 kHz, and 48 kHz Sample Rates
- Flexible Serial Data Port with Right-Justified, Left-Justified, I^{2}S, and DSP Modes
- 28-Lead SSOP Plastic Package

APPLICATIONS

- High End DVD Audio
- SACD
- CD
- Home Theater Systems
- Automotive Audio Systems
- Sampling Musical Keyboards
- Digital Mixing Consoles
- Digital Audio Effects Processors

FUNCTIONAL BLOCK DIAGRAM



PRODUCT OVERVIEW

The AD1955 is a complete, high performance, single-chip, stereo digital audio playback system. It is comprised of a multibit sigma-delta modulator, high performance digital interpolation filters, and continuous-time differential current output DACs. Other features include an on-chip clickless stereo attenuator and mute capability, programmed through an SPI compatible serial control port. The AD1955 is fully compatible with all known DVD audio formats including 192 kHz as well as 96 kHz sample frequencies and 24 bits. It is also backward compatible by supporting 50 µs/15 µs digital de-emphasis intended for "redbook" compact discs, as well as de-emphasis at 32 kHz and 48 kHz sample rates.

The AD1955 has a very flexible serial data input port that allows for glueless interconnection to a variety of ADCs, DSPs, SACD decoders, external digital filters, AES/EBU receivers, and

(continued on page 12)

REV. 0

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781/329-4700 www.analog.com
Fax: 781/326-8703

ABSOLUTE MAXIMUM RATINGS*

Parameter	Min	Max	Unit
DV_{DD} to DGND	–0.3	6	V
AV_{DD} to AGND	–0.3	6	V
Digital Inputs	DGND – 0.3	DV_{DD} + 0.3	V
Analog Outputs	AGND – 0.3	AV_{DD} + 0.3	V
AGND to DGND	–0.3	+0.3	V
Reference Voltage		(AV_{DD} + 0.3)/2	
Soldering		300	°C
		10	sec

*Stresses greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

PACKAGE CHARACTERISTICS

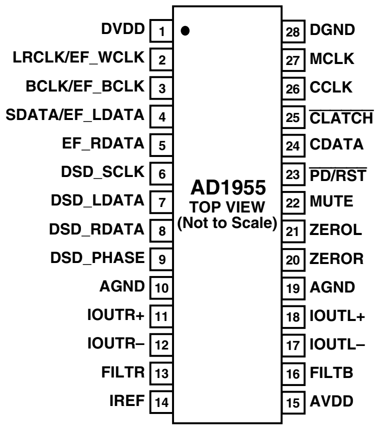
Package	Typ	Unit
θ_{JA} (Thermal Resistance [Junction-to-Ambient])	109.0	°C/W
θ_{JC} (Thermal Resistance [Junction-to-Case])	39.0	°C/W

ORDERING GUIDE

Model	Temperature	Package Description	Package Option*
AD1955ARS	–40°C to +85°C	28-Lead SSOP	RS-28
AD1955ARSRL	–40°C to +85°C	28-Lead SSOP	RS-28 on 13" Reels
EVAL-AD1955EB		Evaluation Board	

*RS = Shrink Small Outline Package

PIN CONFIGURATION



CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the AD1955 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



Advanced Monolithic Systems

AMS1117

1A LOW DROPOUT VOLTAGE REGULATOR

FEATURES

- **Three Terminal Adjustable or Fixed Voltages***
  1.5V, 1.8V, 2.5V, 2.85V, 3.3V and 5.0V
- **Output Current of 1A**
- **Operates Down to 1V Dropout**
- **Line Regulation: 0.2% Max.**
- **Load Regulation: 0.4% Max.**
- **SOT-223, TO-252 and SO-8 package available**

APPLICATIONS

- **High Efficiency Linear Regulators**
- **Post Regulators for Switching Supplies**
- **5V to 3.3V Linear Regulator**
- **Battery Chargers**
- **Active SCSI Terminators**
- **Power Management for Notebook**
- **Battery Powered Instrumentation**

GENERAL DESCRIPTION

The AMS1117 series of adjustable and fixed voltage regulators are designed to provide 1A output current and to operate down to 1V input-to-output differential. The dropout voltage of the device is guaranteed maximum 1.3V at maximum output current, decreasing at lower load currents.

On-chip trimming adjusts the reference voltage to 1%. Current limit is also trimmed, minimizing the stress under overload conditions on both the regulator and power source circuitry.

The AMS1117 devices are pin compatible with other three-terminal SCSI regulators and are offered in the low profile surface mount SOT-223 package, in the 8L SOIC package and in the TO-252 (DPAK) plastic package.

ORDERING INFORMATION:

PACKAGE TYPE			OPERATING JUNCTION TEMPERATURE RANGE
TO-252	SOT-223	8L SOIC	
AMS1117CD	AMS1117	AMS1117CS	-40 to 125° C
AMS1117CD-1.5	AMS1117-1.5	AMS1117CS-1.5	-40 to 125° C
AMS1117CD-1.8	AMS1117-1.8	AMS1117CS-1.8	-40 to 125° C
AMS1117CD-2.5	AMS1117-2.5	AMS1117CS-2.5	-40 to 125° C
AMS1117CD-2.85	AMS1117-2.85	AMS1117CS-2.85	-40 to 125° C
AMS1117CD-3.3	AMS1117-3.3	AMS1117CS-3.3	-40 to 125° C
AMS1117CD-5.0	AMS1117-5.0	AMS1117CS-5.0	-40 to 125° C

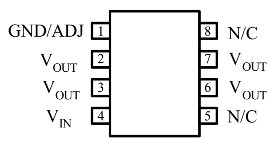
*For additional available fixed voltages contact factory.

PIN CONNECTIONS

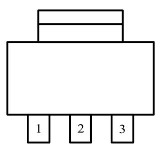
3 PIN FIXED/ADJUSTABLE VERSION

1- Ground/Adjust
2- V_{OUT}
3- V_{IN}

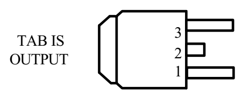
8L SOIC Top View



SOT-223 Top View



TO-252 FRONT VIEW



NEW PRODUCT

BSS123

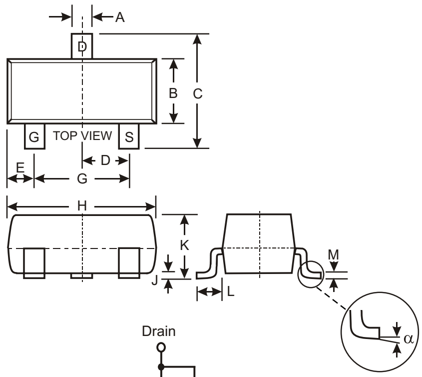
N-CHANNEL ENHANCEMENT MODE FIELD EFFECT TRANSISTOR

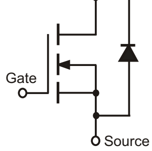
Features

- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- High Drain-Source Voltage Rating

Mechanical Data

- Case: SOT-23, Molded Plastic
- Case material - UL Flammability Rating 94V-0
- Moisture sensitivity: Level 1 per J-STD-020A
- Terminals: Solderable per MIL-STD-202, Method 208
- Terminal Connections: See Diagram
- Marking: K23 (See Page 3)
- Ordering & Date Code Information: See Page 3
- Weight: 0.008 grams (approx.)





SOT-23		
Dim	**Min**	**Max**
A	0.37	0.51
B	1.20	1.40
C	2.30	2.50
D	0.89	1.03
E	0.45	0.60
G	1.78	2.05
H	2.80	3.00
J	0.013	0.10
K	0.903	1.10
L	0.45	0.61
M	0.085	0.180
α	0°	8°
All Dimensions in mm		

Maximum Ratings @ T_A = 25°C unless otherwise specified

Characteristic		Symbol	BSS123	Units
Drain-Source Voltage		V_{DSS}	100	V
Drain-Gate Voltage $R_{GS} \le 20K\Omega$		V_{DGR}	100	V
Gate-Source Voltage	Continuous	V_{GSS}	±20	V
Drain Current (Note 1)	Continuous Pulsed	I_D I_{DM}	170 680	mA
Total Power Dissipation (Note 1)		P_d	300	mW
Thermal Resistance, Junction to Ambient (Note 1)		$R_{\theta JA}$	417	°C/W
Operating and Storage Temperature Range		T_j, T_{STG}	-55 to +150	°C

Note: 1. Part mounted on FR-4 board with recommended pad layout, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.

Integrated
Circuit
Systems, Inc.

ICS83905

Low Skew, 1:6 Crystal Interface-to-LVCMOS / LVTTL Fanout Buffer

General Description

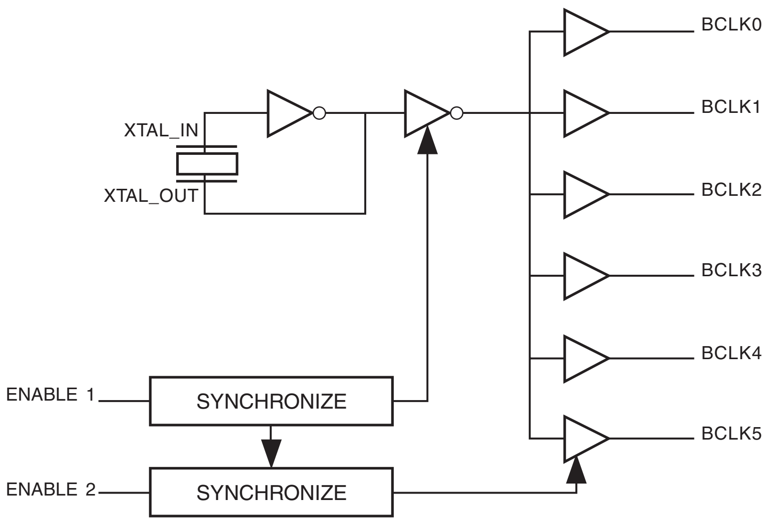
The ICS83905 is a low skew, 1-to-6 LVCMOS / LVTTL Fanout Buffer and a member of the HiPerClockS™ family of High Performance Clock Solutions from ICS. The ICS83905 single ended clock input accepts LVCMOS or LVTTL input levels. The low impedance LVCMOS/LVTTL outputs are designed to drive 50Ω series or parallel terminated transmission lines. The effective fanout can be increased from 6 to 12 by utilizing the ability of the outputs to drive two series terminated lines.

The ICS83905 is characterized at full 3.3V, 2.5V, and 1.8V, mixed 3.3V/2.5V, 3.3V/1.8V and 2.5V/1.8V output operating supply mode. Guaranteed output and part-to-part skew characteristics along with the 1.8V output capabilities makes the ICS83905 ideal for high performance, single ended applications that also require a limited output voltage.

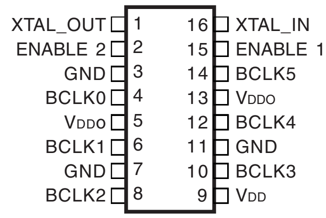
Features

- 6 LVCMOS / LVTTL outputs
- Crystal oscillator interface
- Output frequency range: 10MHz to 50MHz
- Crystal input frequency range: 10MHz to 50MHz
- Output skew: 10ps (typical)
- 5V tolerant enable inputs
- Synchronous output enables
- Operating supply modes: Full 3.3V, 2.5V and 1.8V, mixed 3.3Vcore/2.5V or1.8V operating supply, and mixed 2.5V core/1.8V operating supply
- 0°C to 70°C ambient operating temperature
- Lead-Free package fully RoHS compliant
- Pin compatible to MPC905
- Industrial version available upon request

Block Diagram

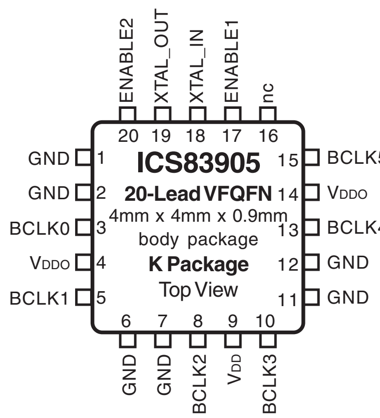


Pin Assignment



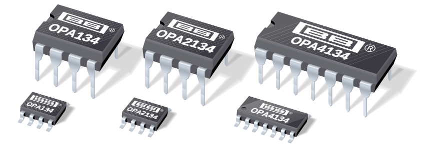
ICS83905
16-Lead SOIC
3.9mm x 9.9mm x 1.38mm body package
M Pacakge
Top View

ICS83905
16-Lead TSSOP
4.4mm x 3.0mm x 0.92mm body package
G Pacakge
Top View



The Preliminary Information presented herein represents a product in prototyping or pre-production. The noted characteristics are based on initial product characterization. Integrated Circuit Systems, Incorporated (ICS) reserves the right to change any circuitry or specifications without notice.

BURR - BROWN®



OPA134
OPA2134
OPA4134

SoundPlus™ High Performance AUDIO OPERATIONAL AMPLIFIERS

FEATURES

- SUPERIOR SOUND QUALITY
- ULTRA LOW DISTORTION: 0.00008%
- LOW NOISE: 8nV/√Hz
- TRUE FET-INPUT: I_B = 5pA
- HIGH SPEED:
  SLEW RATE: 20V/μs
  BANDWIDTH: 8MHz
- HIGH OPEN-LOOP GAIN: 120dB (600Ω)
- WIDE SUPPLY RANGE: ±2.5V to ±18V
- SINGLE, DUAL, AND QUAD VERSIONS

APPLICATIONS

- PROFESSIONAL AUDIO AND MUSIC
- LINE DRIVERS
- LINE RECEIVERS
- MULTIMEDIA AUDIO
- ACTIVE FILTERS
- PREAMPLIFIERS
- INTEGRATORS
- CROSSOVER NETWORKS

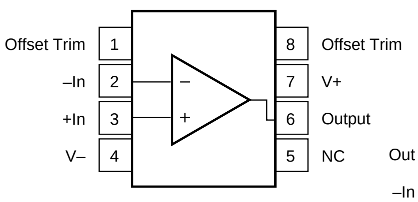
DESCRIPTION

The OPA134 series are ultra-low distortion, low noise operational amplifiers fully specified for audio applications. A true FET input stage was incorporated to provide superior sound quality and speed for exceptional audio performance. This in combination with high output drive capability and excellent dc performance allows use in a wide variety of demanding applications. In addition, the OPA134's wide output swing, to within 1V of the rails, allows increased headroom making it ideal for use in any audio circuit.

OPA134 op amps are easy to use and free from phase inversion and overload problems often found in common FET-input op amps. They can be operated from ±2.5V to ±18V power supplies. Input cascode circuitry provides excellent common-mode rejection and maintains low input bias current over its wide input voltage range, minimizing distortion. OPA134 series op amps are unity-gain stable and provide excellent dynamic behavior over a wide range of load conditions, including high load capacitance. The dual and quad versions feature completely independent circuitry for lowest crosstalk and freedom from interaction, even when overdriven or overloaded.

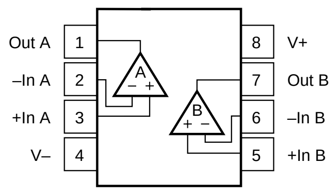
Single and dual versions are available in 8-pin DIP and SO-8 surface-mount packages in standard configurations. The quad is available in 14-pin DIP and SO-14 surface mount packages. All are specified for –40°C to +85°C operation. A SPICE macromodel is available for design analysis.

OPA134



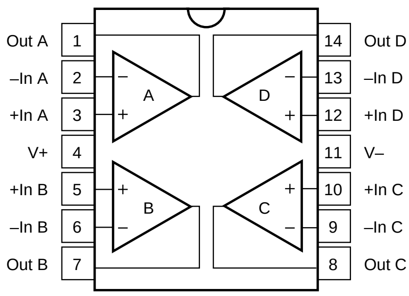
8-Pin DIP, SO-8

OPA2134



8-Pin DIP, SO-8

OPA4134



14-Pin DIP
SO-14

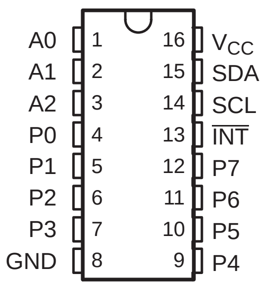
International Airport Industrial Park • Mailing Address: PO Box 11400, Tucson, AZ 85734 • Street Address: 6730 S. Tucson Blvd., Tucson, AZ 85706 • Tel: (520) 746-1111 • Twx: 910-952-1111
Internet: http://www.burr-brown.com/ • FAXLine: (800) 548-6133 (US/Canada Only) • Cable: BBRCORP • Telex: 066-6491 • FAX: (520) 889-1510 • Immediate Product Info: (800) 548-6132

 PDS-1339C Printed in U.S.A. December, 1997

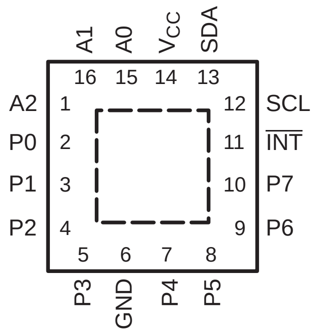
FEATURES

- I²C to Parallel Port Expander
- Open-Drain Active-Low Interrupt Output
- Operating Power-Supply Voltage Range of 2.3 V to 5.5 V
- 5-V Tolerant I/Os
- 400-kHz Fast I²C Bus
- Three Hardware Address Pins Allow up to Eight Devices on the I²C/SMBus
- Input/Output Configuration Register
- Polarity Inversion Register
- Internal Power-On Reset
- Power-Up With All Channels Configured as Inputs
- No Glitch on Power-Up
- Latched Outputs With High-Current Drive Maximum Capability for Directly Driving LEDs
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

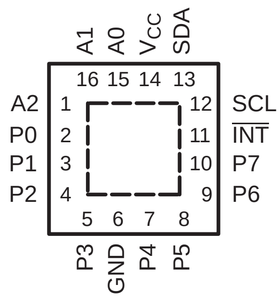
DB, DBQ, DGV, DW,
OR PW PACKAGE
(TOP VIEW)



RGV PACKAGE
(TOP VIEW)



RGT PACKAGE
(TOP VIEW)



DESCRIPTION/ORDERING INFORMATION

This 8-bit I/O expander for the two-line bidirectional bus (I²C) is designed for 2.3-V to 5.5-V V_{CC} operation. It provides general-purpose remote I/O expansion for most microcontroller families via the I²C interface [serial clock (SCL), serial data (SDA)].

The PCA9554A consists of one 8-bit Configuration (input or output selection), Input, Output, and Polarity Inversion (active high or active low) registers. At power-on, the I/Os are configured as inputs with a weak pull up to V_{CC}. However, the system master can enable the I/Os as either inputs or outputs by writing to the I/O configuration bits. The data for each input or output is kept in the corresponding Input or Output register. The polarity of the Input Port register can be inverted with the Polarity Inversion register. All registers can be read by the system master.

The system master can reset the PCA9554A in the event of a timeout or other improper operation by utilizing the power-on reset feature which puts the registers in their default state and initializes the I²C/SMBus state machine.

The PCA9554A open-drain interrupt ($\overline{INT}$) output is activated when any input state differs from its corresponding Input Port register state and is used to indicate to the system master that an input state has changed.

$\overline{INT}$ can be connected to the interrupt input of a microcontroller. By sending an interrupt signal on this line, the remote I/O can inform the microcontroller if there is incoming data on its ports without having to communicate via the I²C bus. Thus, the PCA9554A can remain a simple slave device.

The device's outputs (latched) have high-current drive capability for directly driving LEDs and low current consumption.



Two-Channel, Asynchronous Sample Rate Converter with Integrated Digital Audio Interface Receiver and Transmitter

FEATURES

- **Two-Channel Asynchronous Sample Rate Converter (SRC)**
  - **Dynamic Range with –60dB Input (A-Weighted): 144dB typical**
  - **Total Harmonic Distortion and Noise (THD+N) with Full-Scale Input: –140dB typical**
  - **Supports Audio Input and Output Data Word Lengths Up to 24 Bits**
  - **Supports Input and Output Sampling Frequencies Up to 216kHz**
  - **Automatic Detection of the Input-to-Output Sampling Ratio**
  - **Wide Input-to-Output Conversion Range: 16:1 to 1:16 Continuous**
  - **Excellent Jitter Attenuation Characteristics**
  - **Digital De-Emphasis Filtering for 32kHz, 44.1kHz, and 48kHz Input Sampling Rates**
  - **Digital Output Attenuation and Mute Functions**
  - **Output Word Length Reduction**
  - **Status Registers and Interrupt Generation for Sampling Ratio and Ready Flags**
- **Digital Audio Interface Transmitter (DIT)**
  - **Supports Sampling Rates Up to 216kHz**
  - **Includes Differential Line Driver and CMOS Buffered Outputs**
  - **Block-Sized Data Buffers for Both Channel Status and User Data**
  - **Status Registers and Interrupt Generation for Flag and Error Conditions**
- **User-Selectable Serial Host Interface: SPI or Philips I^2C™**
  - **Provides Access to On-Chip Registers and Data Buffers**
- **Digital Audio Interface Receiver (DIR)**
  - **PLL Lock Range Includes Sampling Rates from 20kHz to 216kHz**
  - **Includes Four Differential Input Line Receivers and an Input Multiplexer**
  - **Bypass Multiplexer Routes Line Receiver Outputs to Line Driver and Buffer Outputs**
  - **Block-Sized Data Buffers for Both Channel Status and User Data**
  - **Automatic Detection of Non-PCM Audio Streams (DTS CD/LD and IEC 61937 formats)**
  - **Audio CD Q-Channel Sub-Code Decoding and Data Buffer**
  - **Status Registers and Interrupt Generation for Flag and Error Conditions**
  - **Low Jitter Recovered Clock Output**
- **Two Audio Serial Ports (Ports A and B)**
  - **Synchronous Serial Interface to External Signal Processors, Data Converters, and Logic**
  - **Slave or Master Mode Operation with Sampling Rates up to 216kHz**
  - **Supports Left-Justified, Right-Justified, and Philips I^2S™ Data Formats**
  - **Supports Audio Data Word Lengths Up to 24 Bits**
- **Four General-Purpose Digital Outputs**
  - **Multifunction Programmable Via Control Registers**
- **Extensive Power-Down Support**
  - **Functional Blocks May Be Disabled Individually When Not In Use**
- **Operates From +1.8V Core and +3.3V I/O Power Supplies**
- **Small TQFP-48 Package, Compatible with the SRC4382 and DIX4192**

WM8740

24-bit, High Performance 192kHz Stereo DAC

Advanced Information, July 2000, Rev 1.7

DESCRIPTION

The WM8740 is a very high performance stereo DAC designed for audio applications such as CD, DVD, home theatre systems, set top boxes and digital TV. The WM8740 supports data input word lengths from 16 to 24-bits and sampling rates up to 192kHz. The WM8740 consists of a serial interface port, digital interpolation filter, multi-bit sigma delta modulator and stereo DAC in a small 28-pin SSOP package. The WM8740 also includes a digitally controllable mute and attenuator function on each channel.

The internal digital filter has two selectable roll-off characteristics. A sharp or slow roll-off can be selected dependent on application requirements. Additionally, the internal digital filter can be by-passed and the WM8740 used with an external digital filter.

The WM8740 supports two connection schemes for audio DAC control. The SPI-compatible serial control port provides access to a wide range of features including on-chip mute, attenuation and phase reversal. A hardware controllable interface is also available.

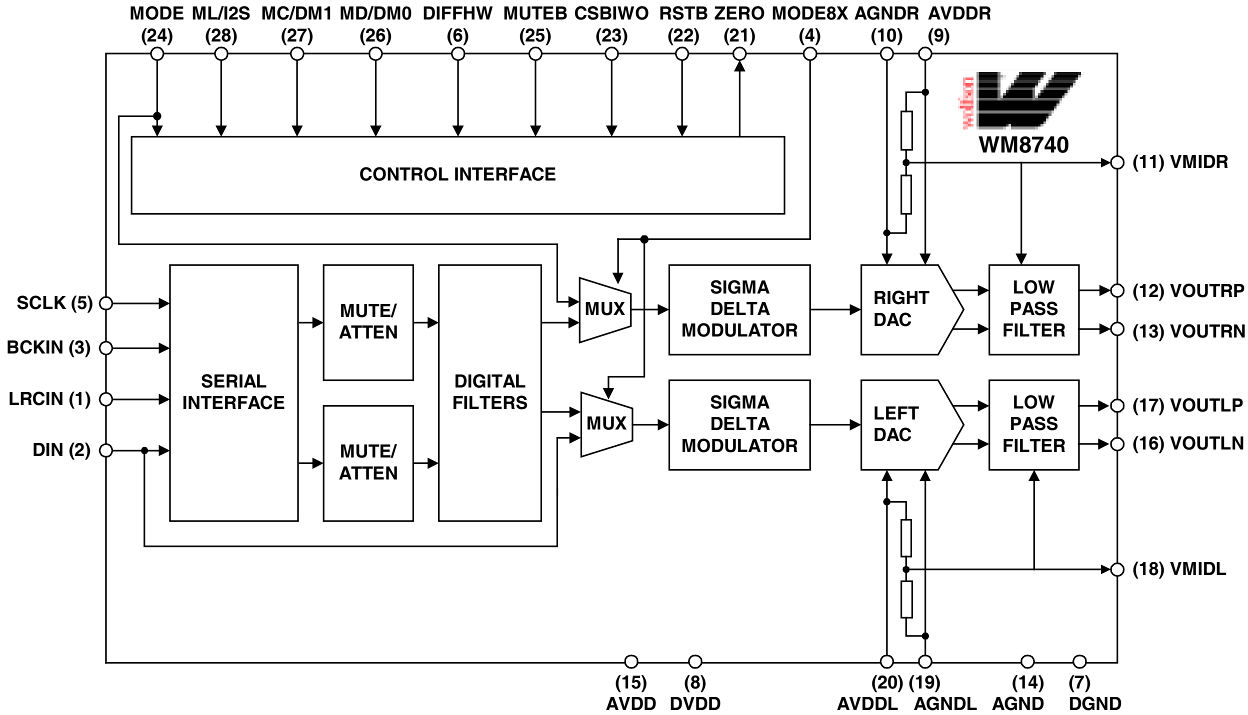
FEATURES

- 120dB SNR (‘A’ weighted mono @48kHz), THD+N: -104dB @ FS
- 117dB SNR (‘A’ weighted stereo @48kHz), THD+N: -104dB @ FS
- Sampling frequency: 8kHz to 192kHz
- Selectable digital filter roll-off
- Optional interface to industry standard external filters
- Differential mono mode needing no glue logic
- Input data word: 16 to 24-bit
- Hardware or SPI compatible serial port control modes:
  - Hardware mode: mute, de-emphasis, audio format control
  - Serial mode: mute, de-emphasis, attenuation (256 steps), phase reversal
- Fully differential voltage outputs

APPLICATIONS

- CD, DVD audio
- Home theatre systems
- Professional audio systems

BLOCK DIAGRAM



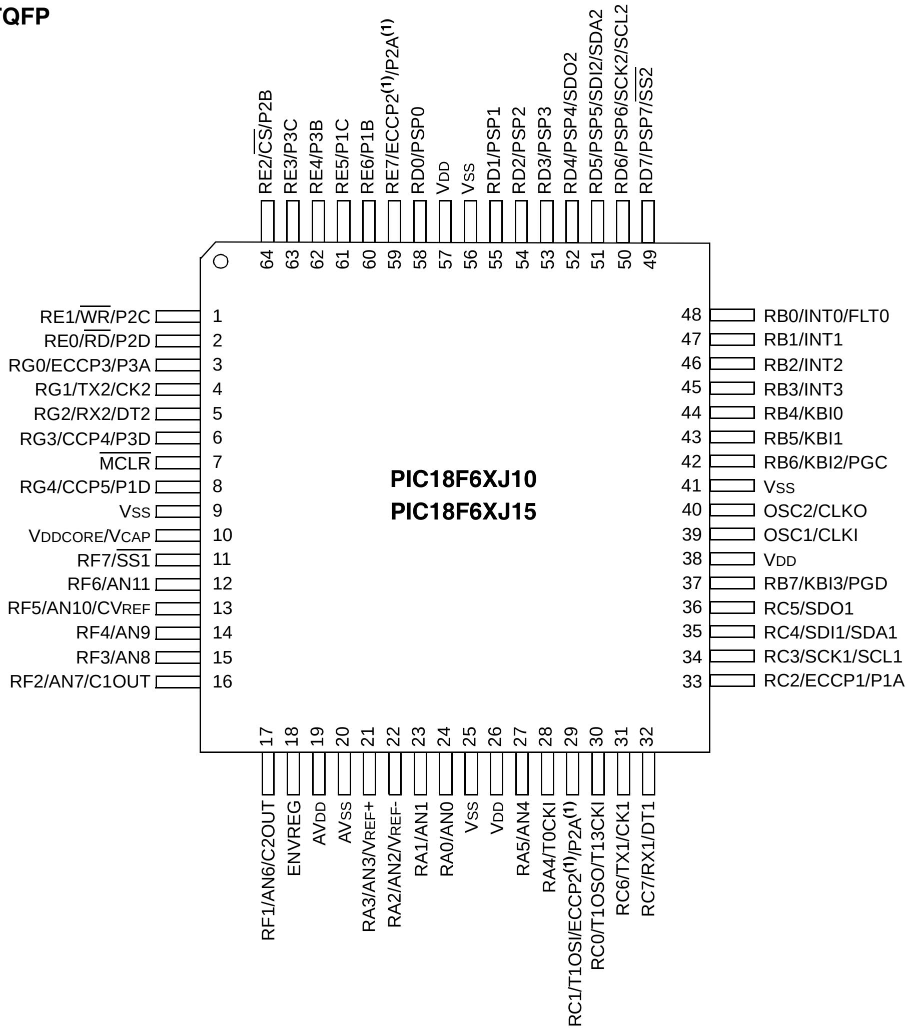
WOLFSON MICROELECTRONICS LTD
Lutton Court, Bernard Terrace, Edinburgh, EH8 9NX, UK
Tel: +44 (0) 131 667 9386
Fax: +44 (0) 131 667 5176
Email: sales@wolfson.co.uk
http://www.wolfson.co.uk

Advanced Information data sheets contain preliminary data on new products in the preproduction phase of development. Supplementary data will be published at a later date.

Device	Program Memory		SRAM Data Memory (bytes)	I/O	10-bit A/D (ch)	CCP/ ECCP (PWM)	MSSP			EUSART	Comparators	Timers 8/16-bit	External Bus
	Flash (bytes)	# Single-Word Instructions						SPI™	Master I²C™				
PIC18F65J10	32K	16384	2048	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F65J15	48K	24576	2048	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F66J10	64K	32768	2048	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F66J15	96K	49152	3936	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F67J10	128K	65536	3936	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F85J10	32K	16384	2048	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F85J15	48K	24576	2048	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F86J10	64K	32768	2048	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F86J15	96K	49152	3936	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F87J10	128K	65536	3936	66	15	2/3	2	Y	Y	2	2	2/3	Y

Pin Diagrams

64-Pin TQFP



Note 1: The ECCP2/P2A pin placement depends on the setting of the CCP2MX configuration bit.

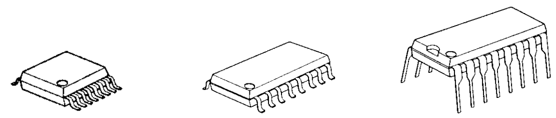
 Advance Information

2-CHANNEL ELECTRONIC VOLUME

■ GENERAL DESCRIPTION

NJW1159 is a two channel electronic volume IC. It is included output buffer amplifier and also resistor output terminal for using external amplifier to customize for your application. These functions are controlled by three-wired serial data. And the chip selector is available for using four chips on same serial bus line. It's available for two-channel stereo and or multi-channel audio volume.

■ PACKAGE OUTLINE

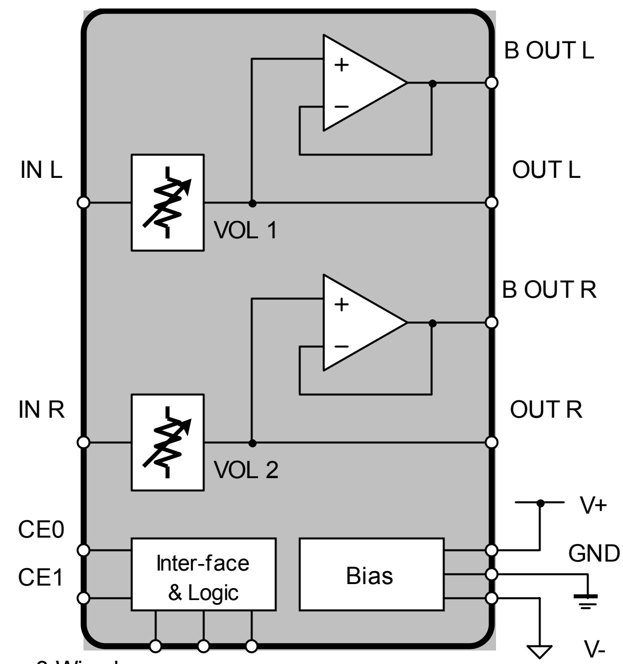


NJW1159V NJW1159M NJW1159D

■ FEATURES

- Operating Voltage ±4.5 to ±7.5V
- Three-Wired Serial Data Control
- Chip Selector available for using four chips on same serial bus line.
- Volume 0 to -95dB/1dBstep, MUTE
- Bi-CMOS Technology
- Package Outline SSOP16, DMP16, DIP16

■ BLOCK DIAGRAM



National Semiconductor

November 2004

LM137/LM337
3-Terminal Adjustable Negative Regulators

General Description

The LM137/LM337 are adjustable 3-terminal negative voltage regulators capable of supplying in excess of −1.5A over an output voltage range of −1.2V to −37V. These regulators are exceptionally easy to apply, requiring only 2 external resistors to set the output voltage and 1 output capacitor for frequency compensation. The circuit design has been optimized for excellent regulation and low thermal transients. Further, the LM137 series features internal current limiting, thermal shutdown and safe-area compensation, making them virtually blowout-proof against overloads.

The LM137/LM337 serve a wide variety of applications including local on-card regulation, programmable-output voltage regulation or precision current regulation. The LM137/LM337 are ideal complements to the LM117/LM317 adjustable positive regulators.

Features

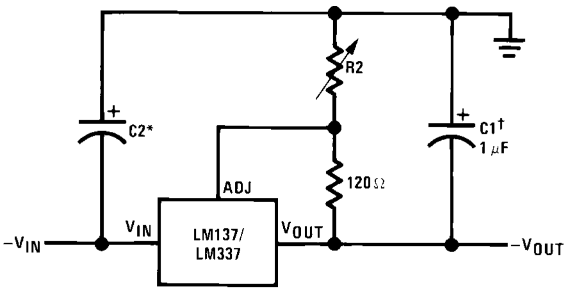
- Output voltage adjustable from −1.2V to −37V
- 1.5A output current guaranteed, −55˚C to +150˚C
- Line regulation typically 0.01%/V
- Load regulation typically 0.3%
- Excellent thermal regulation, 0.002%/W
- 77 dB ripple rejection
- Excellent rejection of thermal transients
- 50 ppm/˚C temperature coefficient
- Temperature-independent current limit
- Internal thermal overload protection
- P^+ Product Enhancement tested
- Standard 3-lead transistor package
- Output is short circuit protected

LM137 Series Packages and Power Capability

Device	Package	Rated Power Dissipation	Design Load Current
LM137/337	TO-3 (K)	20W	1.5A
	TO-39 (H)	2W	0.5A
LM337	TO-220 (T)	15W	1.5A
LM337	SOT-223 (MP)	2W	1A

Typical Applications

Adjustable Negative Voltage Regulator



Full output current not available at high input-output voltages

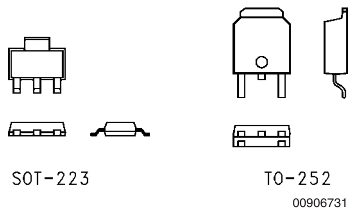
$$-V_{OUT} = -1.25V\left(1 + \frac{R2}{120}\right) + \left(-I_{ADJ} \times R2\right)$$

†C1 = 1 µF solid tantalum or 10 µF aluminum electrolytic required for stability

*C2 = 1 µF solid tantalum is required only if regulator is more than 4" from power-supply filter capacitor

Output capacitors in the range of 1 µF to 1000 µF of aluminum or tantalum electrolytic are commonly used to provide improved output impedance and rejection of transients

Comparison between SOT-223 and D-Pak (TO-252) Packages



Scale 1:1

 DS009067 www.national.com

National Semiconductor

August 1999

LM117/LM317A/LM317 3-Terminal Adjustable Regulator

General Description

The LM117 series of adjustable 3-terminal positive voltage regulators is capable of supplying in excess of 1.5A over a 1.2V to 37V output range. They are exceptionally easy to use and require only two external resistors to set the output voltage. Further, both line and load regulation are better than standard fixed regulators. Also, the LM117 is packaged in standard transistor packages which are easily mounted and handled.

In addition to higher performance than fixed regulators, the LM117 series offers full overload protection available only in IC's. Included on the chip are current limit, thermal overload protection and safe area protection. All overload protection circuitry remains fully functional even if the adjustment terminal is disconnected.

Normally, no capacitors are needed unless the device is situated more than 6 inches from the input filter capacitors in which case an input bypass is needed. An optional output capacitor can be added to improve transient response. The adjustment terminal can be bypassed to achieve very high ripple rejection ratios which are difficult to achieve with standard 3-terminal regulators.

Besides replacing fixed regulators, the LM117 is useful in a wide variety of other applications. Since the regulator is "floating" and sees only the input-to-output differential voltage, supplies of several hundred volts can be regulated as long as the maximum input to output differential is not exceeded, i.e., avoid short-circuiting the output.

Also, it makes an especially simple adjustable switching regulator, a programmable output regulator, or by connecting a fixed resistor between the adjustment pin and output, the LM117 can be used as a precision current regulator. Supplies with electronic shutdown can be achieved by clamping the adjustment terminal to ground which programs the output to 1.2V where most loads draw little current.

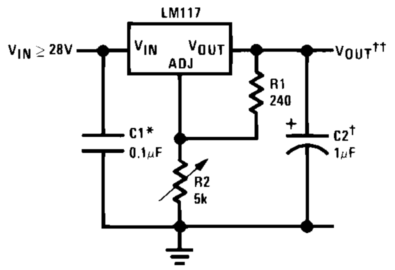
For applications requiring greater output current, see LM150 series (3A) and LM138 series (5A) data sheets. For the negative complement, see LM137 series data sheet.

Features

- Guaranteed 1% output voltage tolerance (LM317A)
- Guaranteed max. 0.01%/V line regulation (LM317A)
- Guaranteed max. 0.3% load regulation (LM117)
- Guaranteed 1.5A output current
- Adjustable output down to 1.2V
- Current limit constant with temperature
- P^+ Product Enhancement tested
- 80 dB ripple rejection
- Output is short-circuit protected

Typical Applications

1.2V–25V Adjustable Regulator



DS009063-1

Full output current not available at high input-output voltages

*Needed if device is more than 6 inches from filter capacitors.

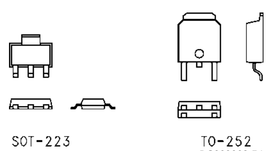
†Optional — improves transient response. Output capacitors in the range of 1 µF to 1000 µF of aluminum or tantalum electrolytic are commonly used to provide improved output impedance and rejection of transients.

$$\dagger\dagger V_{OUT} = 1.25V\left(1 + \frac{R2}{R1}\right) + I_{ADJ}(R_2)$$

LM117 Series Packages

Part Number Suffix	Package	Design Load Current
K	TO-3	1.5A
H	**TO-39**	**0.5A**
T	TO-220	1.5A
E	**LCC**	**0.5A**
S	TO-263	1.5A
EMP	SOT-223	1A
MDT	**TO-252**	**0.5A**

SOT-223 vs D-Pak (TO-252) Packages



DS009063-54

Scale 1:1

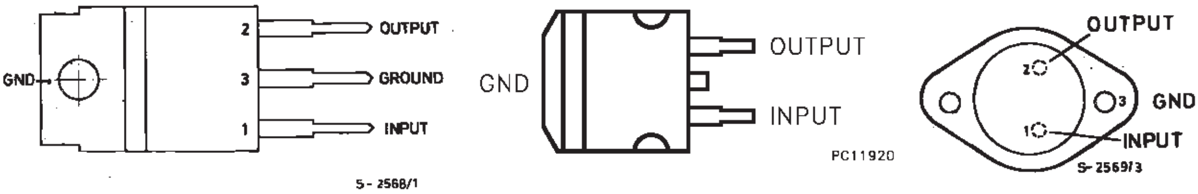
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_i	DC Input Voltage (for V_O = 5 to 18V) (for V_O = 20, 24V)	35 40	V V
I_o	Output Current	Internally limited	
P_{tot}	Power Dissipation	Internally limited	
T_{op}	Operating Junction Temperature Range (for **L7800**) (for **L7800C**)	-55 to 150 0 to 150	^oC ^oC
T_{stg}	Storage Temperature Range	-65 to 150	^oC

THERMAL DATA

Symbol	Parameter		D^2PAK	TO-220	TO-220FP	TO-3	Unit
$R_{thj-case}$	Thermal Resistance Junction-case	Max	3	3	5	4	$^oC/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5	50	60	35	$^oC/W$

CONNECTION DIAGRAM AND ORDERING NUMBERS (top view)



TO-220 & TO-220FP D^2PAK TO-3

Type	TO-220	D^2PAK (*)	TO-220FP	TO-3	Output Voltage
L7805				L7805T	5V
L7805C	L7805CV	L7805CD2T	L7805CP	L7805CT	5V
L7852C	L7852CV	L7852CD2T	L7852CP	L7852CT	5.2V
L7806				L7806T	6V
L7806C	L7806CV	L7806CD2T	L7806CP	L7806CT	6V
L7808				L7808T	8V
L7808C	L7808CV	L7808CD2T	L7808CP	L7808CT	8V
L7885C	L7885CV	L7885CD2T	L7885CP	L7885CT	8.5V
L7809C	L7809CV	L7809CD2T	L7809CP	L7809CT	9V
L7812				L7812T	12V
L7812C	L7812CV	L7812CD2T	L7812CP	L7812CT	12V
L7815				L7815T	15V
L7815C	L7815CV	L7815CD2T	L7815CP	L7815CT	15V
L7818				L7818T	18V
L7818C	L7818CV	L7818CD2T	L7818CP	L7818CT	18V
L7820				L7820T	20V
L7820C	L7820CV	L7820CD2T	L7820CP	L7820CT	20V
L7824				L7824T	24V
L7824C	L7824CV	L7824CD2T	L7824CP	L7824CT	24V

(*) AVAILABLE IN TAPE AND REEL WITH "-TR" SUFFIX

Advanced Monolithic Systems

AMS1085CT

3A LOW DROPOUT VOLTAGE REGULATOR

FEATURES

- **Three Terminal Adjustable or Fixed Voltages 1.5V, 2.5V, 2.85V, 3.0V, 3.3V, 3.5V and 5.0V**
- **Output Current of 3A**
- **Operates Down to 1V Dropout**
- **Load Regulation: 0.1%**
- **Line Regulation: 0.015%**
- **TO-220, TO-263 and TO-252 packages available**

APPLICATIONS

- **High Efficiency Linear Regulators**
- **Post Regulators for Switching Supplies**
- **Microprocessor Supply**
- **Battery Chargers**
- **Constant Current Regulators**
- **Notebook/Personal Computer Supplies**
- **Portable Instrumentation**

GENERAL DESCRIPTION

The AMS1085 series of adjustable and fixed voltage regulators are designed to provide 3A output current and to operate down to 1V input-to-output differential. The dropout voltage of the device is guaranteed maximum 1.5V at maximum output current, decreasing at lower load currents.

On-chip trimming adjusts the reference voltage to 1%. Current limit is also trimmed, minimizing the stress under overload conditions on both the regulator and power source circuitry.

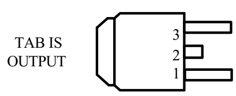
The AMS1085 devices are pin compatible with older three-terminal regulators and are offered in 3 lead TO-220 package, 3 and 2 lead TO-263 (Plastic DD) and TO-252 (D PAK) package.

ORDERING INFORMATION:

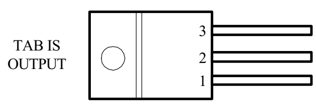
PACKAGE TYPE			OPERATING JUNCTION TEMPERATURE RANGE
3 LEAD TO-220	2&3 LEAD TO-263	TO-252	
AMS1085CT	AMS1085CM	AMS1085CD	0 to 125° C
AMS1085CT-1.5	AMS1085CM-1.5	AMS1085CD-1.5	0 to 125° C
AMS1085CT-2.5	AMS1085CM-2.5	AMS1085CD-2.5	0 to 125° C
AMS1085CT-2.85	AMS1085CM-2.85	AMS1085CD-2.85	0 to 125° C
AMS1085CT-3.0	AMS1085CM-3.0	AMS1085CD-3.0	0 to 125° C
AMS1085CT-3.3	AMS1085CM-3.3	AMS1085CD-3.3	0 to 125° C
AMS1085CT-3.5	AMS1085CM-3.5	AMS1085CD-3.5	0 to 125° C
AMS1085CT-5.0	AMS1085CM-5.0	AMS1085CD-5.0	0 to 125° C

PIN CONNECTIONS

TO-252 FRONT VIEW



TO-220 FRONT VIEW



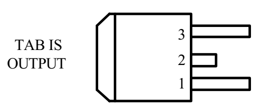
FIXED VERSION

1- Ground
2- V_{OUT}
3- V_{IN}

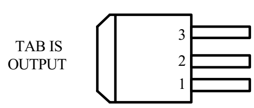
ADJUSTABLE VERSION

1- Adjust
2- V_{OUT}
3- V_{IN}

2L TO-263 FRONT VIEW



3L TO-263 FRONT VIEW



Advanced Monolithic Systems, Inc. 6680B Sierra Lane, Dublin, CA 94568 Phone (925) 556-9090 Fax (925) 556-9140

Low Cost, General Purpose High Speed JFET Amplifier

AD825

FEATURES
High Speed
- **41 MHz, –3 dB Bandwidth**
- **125 V/μs Slew Rate**
- **80 ns Settling Time**

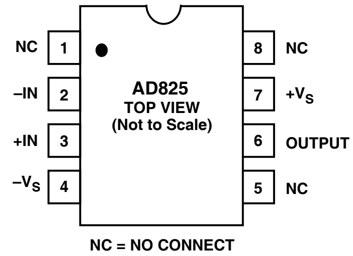
Input Bias Current of 20 pA and Noise Current of 10 fA/$\sqrt{Hz}$
Input Voltage Noise of 12 nV/$\sqrt{Hz}$
Fully Specified Power Supplies: ±5 V to ±15 V
Low Distortion: –76 dB at 1 MHz
High Output Drive Capability
- **Drives Unlimited Capacitance Load**
- **50 mA Min Output Current**

No Phase Reversal When Input Is at Rail
Available in 8-Lead SOIC

APPLICATIONS
CCD
Low Distortion Filters
Mixed Gain Stages
Audio Amplifier
Photo Detector Interface
ADC Input Buffer
DAC Output Buffer

CONNECTION DIAGRAM

8-Lead Plastic SOIC (R) Package



PRODUCT DESCRIPTION

The AD825 is a superbly optimized operational amplifier for high speed, low cost and dc parameters, making it ideally suited for a broad range of signal conditioning and data acquisition applications. The ac performance, gain, bandwidth, slew rate and drive capability are all very stable over temperature. The AD825 also maintains stable gain under varying load conditions.

The unique input stage has ultralow input bias current and ultralow input current noise. Signals that go to either rail on this high performance input do not cause phase reversals at the output. These features make the AD825 a good choice as a buffer for MUX outputs, creating minimal offset and gain errors.

The AD825 is fully specified for operation with dual ±5 V and ±15 V supplies. This power supply flexibility, and the low supply current of 6.5 mA with excellent ac characteristics under all supply conditions, makes the AD825 well suited for many demanding applications.

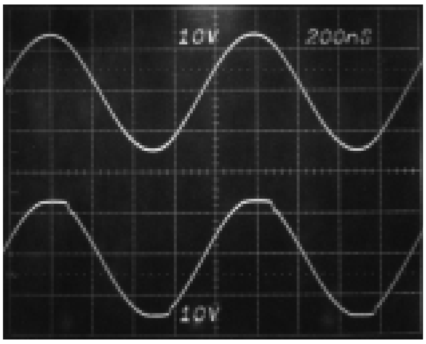


Figure 1. Performance with Rail-to-Rail Input Signals

REV. C

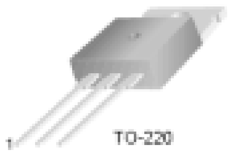
One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781/329-4700 World Wide Web Site: http://www.analog.com
Fax: 781/326-8703

FAIRCHILD SEMICONDUCTOR®

July 2008

TIP31/TIP31A/TIP31B/TIP31C
NPN Epitaxial Silicon Transistor

Features
- Complementary to TIP32/TIP32A/TIP32B/TIP32C



1. Base 2. Collector 3. Emitter

Absolute Maximum Ratings T_C=25°C unless otherwise noted

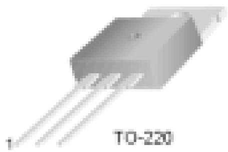
Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage : TIP31 : TIP31A : TIP31B : TIP31C	40 60 80 100	V V V V
V_{CEO}	Collector-Emitter Voltage : TIP31 : TIP31A : TIP31B : TIP31C	40 60 80 100	V V V V
V_{EBO}	Emitter-Base Voltage	5	V
I_C	Collector Current (DC)	3	A
I_{CP}	Collector Current (Pulse)	5	A
I_B	Base Current	1	A
P_C	Collector Dissipation (T_C=25°C)	40	W
	Collector Dissipation (T_a=25°C)	2	W
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	- 65 ~ 150	°C

FAIRCHILD SEMICONDUCTOR®

July 2008

TIP32/TIP32A/TIP32B/TIP32C
PNP Epitaxial Silicon Transistor

Features
- Complementary to TIP31/TIP31A/TIP31B/TIP31C



1. Base 2. Collector 3. Emitter

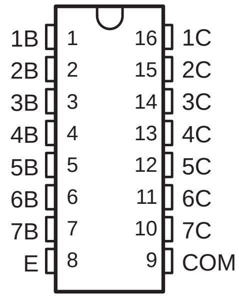
Absolute Maximum Ratings T_C=25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage : TIP32 : TIP32A : TIP32B : TIP32C	- 40 - 60 - 80 - 100	V V V V
V_{CEO}	Collector-Emitter Voltage : TIP32 : TIP32A : TIP32B : TIP32C	- 40 - 60 - 80 -100	V V V V
V_{EBO}	Emitter-Base Voltage	- 5	V
I_C	Collector Current (DC)	- 3	A
I_{CP}	Collector Current (Pulse)	- 5	A
I_B	Base Current	- 3	A
P_C	Collector Dissipation (T_C=25°C)	40	W
	Collector Dissipation (T_a=25°C)	2	W
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	- 65 ~ 150	°C

HIGH-VOLTAGE HIGH-CURRENT DARLINGTON TRANSISTOR ARRAYS

- **500-mA Rated Collector Current (Single Output)**
- **High-Voltage Outputs . . . 50 V**
- **Output Clamp Diodes**
- **Inputs Compatible With Various Types of Logic**
- **Relay Driver Applications**
- **Designed to Be Interchangeable With Sprague ULN2001A Series**

D OR N PACKAGE
(TOP VIEW)

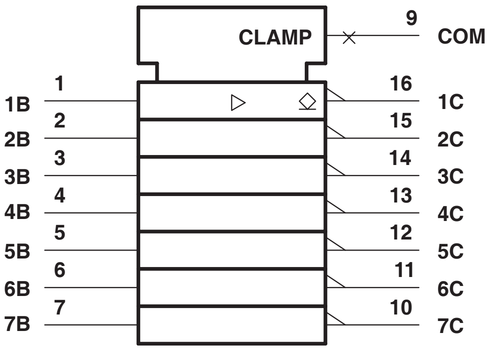


description

The ULN2001A, ULN2002A, ULN2003A, and ULN2004A are monolithic high-voltage, high-current Darlington transistor arrays. Each consists of seven npn Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of a single Darlington pair is 500 mA. The Darlington pairs may be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers. For 100-V (otherwise interchangeable) versions, see the SN75465 through SN75469.

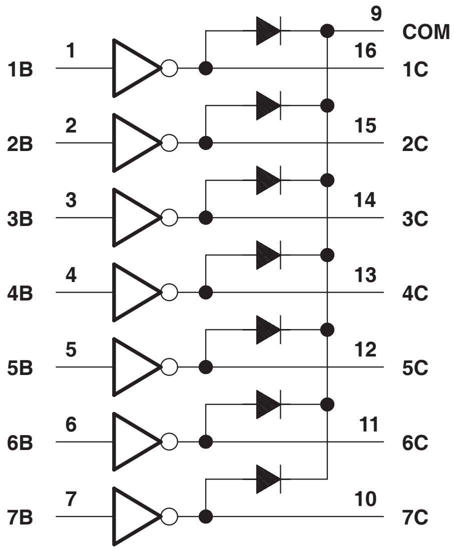
The ULN2001A is a general-purpose array and can be used with TTL and CMOS technologies. The ULN2002A is specifically designed for use with 14- to 25-V PMOS devices. Each input of this device has a zener diode and resistor in series to control the input current to a safe limit. The ULN2003A has a 2.7-kΩ series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices. The ULN2004A has a 10.5-kΩ series base resistor to allow its operation directly from CMOS devices that use supply voltages of 6 to 15 V. The required input current of the ULN2004A is below that of the ULN2003A, and the required voltage is less than that required by the ULN2002A.

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram



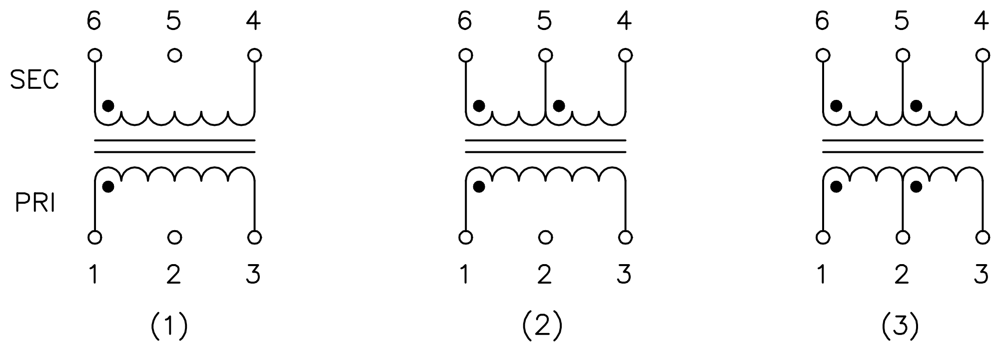
Wide Band RF Transformer
for Set-Top Box and Cable Modem Applications

Hanrun Electronics Company Limited

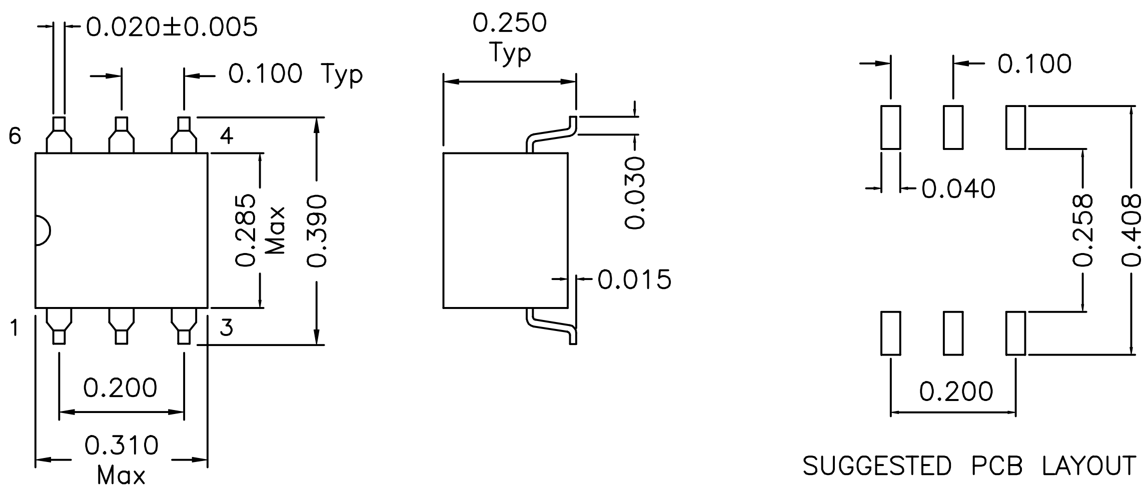
Electrical Specification @25°C

Part Number	Schematic	Impedance Ratio	Frequency Bandwidth (MHz)	PIN1−3 OCL uH (Min)	PIN1−3 DCR ohm (Max)	PIN6−4 OCL uH (Min)	PIN6−4 DCR ohm (Max)
HR600601	(1)	1:1	0.005 ~ 100	780	0.320	780	0.320
HR600602	(1)	1:1	0.04 ~ 175	95	0.200	95	0.200
HR600603	(1)	1.5:1	0.1 ~ 150	80	0.145	51	0.130
HR600604	(1)	4:1	0.2 ~ 300	95	0.160	25	0.115
HR600605	(2)	1:1	0.005 ~ 100	780	0.320	780	0.320
HR600606	(2)	1:1	0.04 ~ 175	95	0.200	95	0.200
HR600607	(2)	4:1	0.2 ~ 300	95	0.160	25	0.115
HR600608	(3)	1:1	0.005 ~ 100	780	0.320	780	0.320
HR600609	(4)	1:1	0.04 ~ 175	95	0.200	95	0.200
HR600610	(5)	1.5:1	0.1 ~ 150	80	0.145	51	0.130
HR600611	(6)	4:1	0.2 ~ 300	95	0.160	25	0.115

Schematics



Mechanical Dimensions



Part No.:	Unless otherwise specified, Tol.:	Rev: A	DRWN:	Date:
Dimensions in inches	.xxx ±0.010	Page 1/1	APPD:	Date:

1 Second Generation Aureus™ DSPs

1.1 Features

- DA708/B/DA788B: 32-/64-Bit 250-/266-MHz Floating-Point DSP
- Upgrades to C67x+ CPU From DA6xx Family:
  - 2X CPU Registers [64 General-Purpose]
  - New Audio-Specific Instructions
  - Compatible With the DA6xx C67x CPU
- Enhanced Memory System
  - 256K-Byte Unified Program/Data RAM
  - 768K-Byte Unified Program/Data ROM
  - Single-Cycle Data Access From CPU
  - Large Program Cache (32K-Byte) Supports RAM, ROM, and External Memory
- External Memory Interface (EMIF) Supports:
  - 100-/133-MHz SDRAM (16-Bit)
  - Async NOR Flash, SRAM (8- or 16-Bit)
  - NAND Flash (8- or 16-Bit)
- Enhanced I/O System
  - High-Performance Crossbar Switch
  - Dedicated McASP DMA Bus
  - Deterministic I/O Performance
- dMAX Dual Data Movement Accelerator:
  - Memory-to-Memory Transfers
  - Memory-to-Peripheral Transfers
  - Packing/Unpacking Delay Data
  - Circular Addressing
  - Non-Sequential Addressing for Reverb
- Three Multichannel Audio Serial Ports
  - Transmit/Receive Clocks up to 50 MHz
  - Five Clock Zones and 16 Serial Data Pins
  - Supports TDM, I2S, and Similar Formats
  - DIT Only (McASP2)
- Two 10-MHz SPI Ports With 3-, 4-, and 5-Pin Options
- Two Inter-Integrated Circuit (I2C) Ports
- Real-Time Interrupt Counter/Watchdog
- Oscillator- and Software-Controlled PLL
- Commercial or Extended Temperature
- 144-Pin, 0.5-mm, PowerPAD™ Thin Quad Flatpack (TQFP) [RFP Suffix]
- Security Features Available
- Applications
  - A/V and DVD Receiver
  - Multizone A/V Receiver
  - HDD Jukebox
  - Navigation Systems
  - High-Speed Encode With Simultaneous Multichannel Decode
- Software Support
  - Dolby® Digital, Dolby® Digital EX, Dolby® Digital Plus, Dolby® TrueHD, Dolby® Pro Logic® IIx, Dolby® Headphone, Dolby® Virtual Surround,
  - DTS®5.1, DTS-ES™ 6.1, DTS Neo:6™, DTS 96/24™, DTS-ES 96/24™, DTS-HD™ (DA788B only)
  - MPEG-2 AAC LC Decode
  - MPEG-4 AAC LC Encode/Decode
  - THX® Select 2, THX® Ultra 2, Neural-THX® Surround
  - MP3 Encode, MP3 Decode
  - WMA8 Encode, WMA9 Decode
  - HDCD® Decode
  - ATRAC3plus® Encode, ATRAC3plus® Decode
  - Audyssey MultEQ XT®, MultEQ®, PrevEQ®, 2EQ®
  - SRS® Circle Surround™ II (CS II)
  - TI Bass Boost
  - TI Perfect Playback™ Compressed Audio Enhancer
  - TI Virtualizer/Headphone
  - TI Effects Library
  - TI DSD-to-PCM Decode
  - TI Filter Library
  - TI Performance Audio Framework (PA/F)
  - TI DSP/BIOS™
  - Chip Support Library and DSP Library

1.2 Trademarks

Aureus, Perfect Playback, DSP/BIOS, PowerPAD, TMS320C6000, C6000, Code Composer Studio, XDS, TMS320, TMS320C62x, and TMS320C67x are trademarks of Texas Instruments.

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SRS is a registered trademark of SRS Labs, Inc. in the U.S. and selected foreign countries.

Circle Surround II is a trademark of SRS Labs, Inc.

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2.13 Pin Maps

Figure 2-2 shows the pin assignments on the 144-pin RFP package.

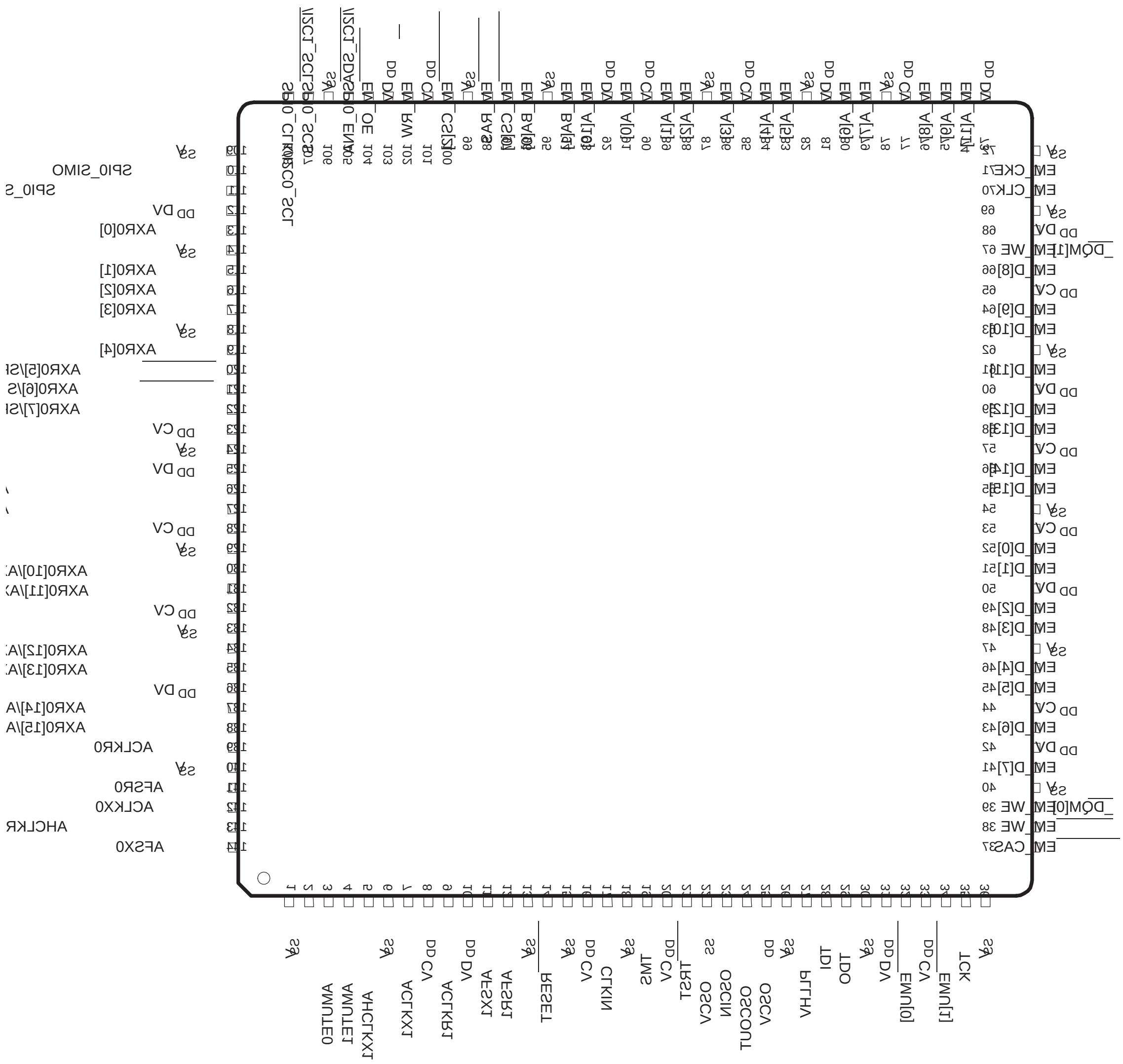
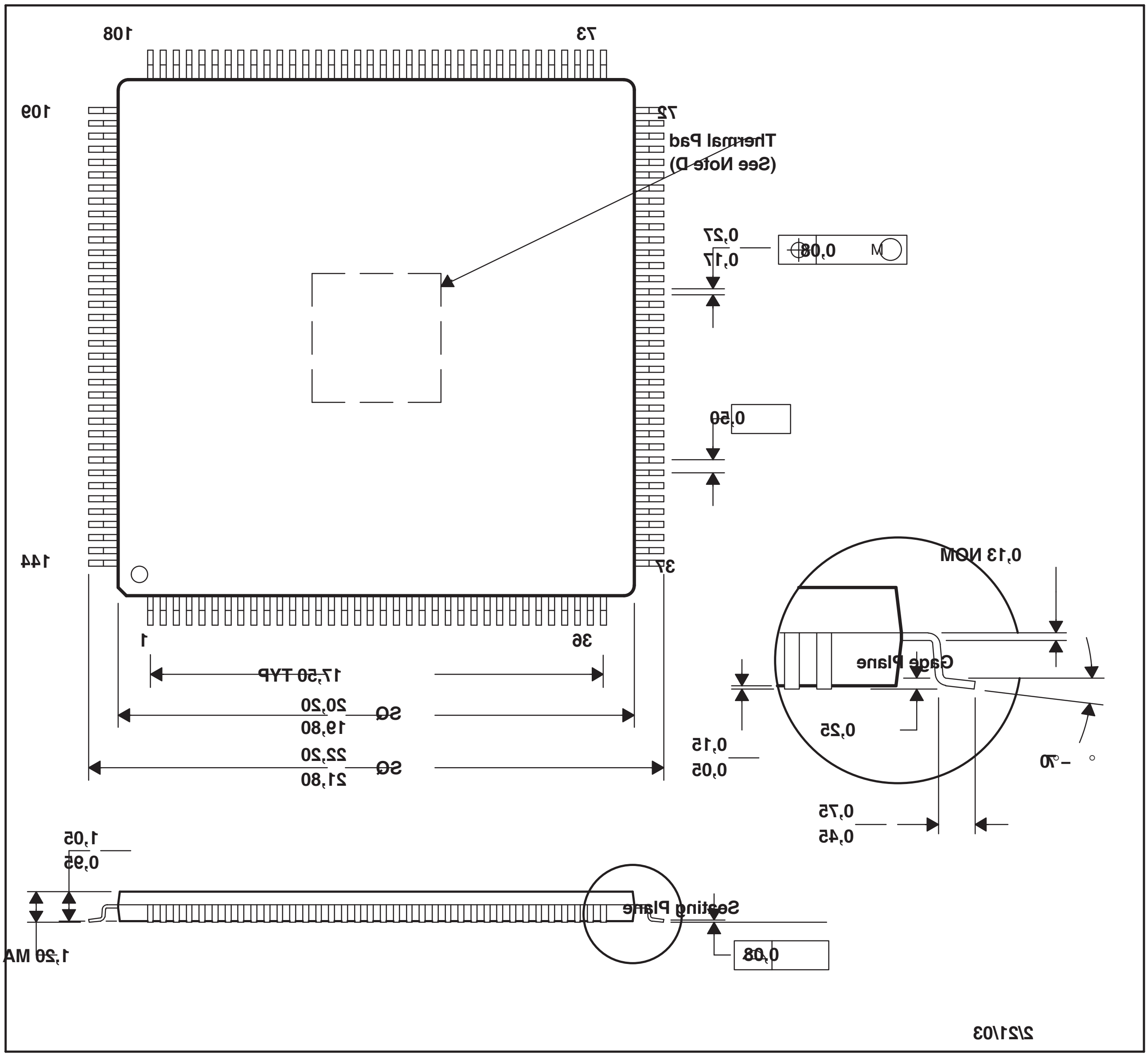


Figure 2-2. 144-Pin Low-Profile Quad Flatpack (RFP Suffix)—Top View

5.3 PowerPAD™ Plastic Quad Flatpack Mechanical Data Drawing (RFP)

DA708/B/DA788B Device-Specific RFP (S-PQFP-G144) PowerPAD™ PLASTIC QUAD FLATPACK



A. All linear dimensions are in millimeters.

B. This drawing is subject to change without notice.

C. Body dimensions do not include mold flash or protrusion.

D. The package thermal performance may be enhanced by bonding the thermal pad to an external plane. This pad is electronically and thermally connected to the backside of the die and possibly selected leads. Actual size: 5.4 mm × 5.4 mm.

E. Falls within JEDEC MS-026.

Document Title

4Bank x 1M x 16bits Synchronous DRAM

Revision History

Revision No.	History	Draft Date	Remark
1.0	First Version Release 1. Changed tOH: 2.0 --> 2.5 [tCK = 7 & 7.5 (CL3) Product]	Nov. 2004	
1.1	1. Changed Input High/Low Voltage (Page 08) 2. Changed DC characteristics (Page 09) - IDD2NS: 18mA -> 15mA - IDD5:210 / 195 / 180mA -> 170 / 160 / 150mA [Speed 200 / 166 / 143 / 133MHz] 3. Changed Clock High / Low pulse width Time (Page 11) 4. Changed tAC Time (Page11) 5. Changed tRRD Time (Page12)	Dec. 2004	
1.2	1. Corrected Revision No.: 2.0 -> 1.1 2. Deleted Remark at Revision History 3. Corrected AC OPERATING CONDITION - CL 50pF -> 30pF 4. Changed DC OPERATING CONDITION - VIH MAX VDDQ+2.0 -> VDDQ+0.3 and Typ 3.3 -> 3.0 - VIL MIN VSSQ-2.0 -> -0.3	Dec. 2004	
1.3	1. Modified note for Super Low Power in ORDERING INFORMATION	Jan. 2005	
1.4	1. Corrected PIN ASSIGNMENT A12 to NC	Jan. 2005	
1.5	1. Corrected comments for overshoot and undershoot	Feb. 2005	

DESCRIPTION

The Hynix HY57V641620E(L/S)T(P) series is a 67,108,864bit CMOS Synchronous DRAM, ideally suited for the memory applications which require wide data I/O and high bandwidth. HY57V641620E(L/S)T(P) is organized as 4banks of 1,048,576x16.

HY57V641620E(L/S)T(P) is offering fully synchronous operation referenced to a positive edge of the clock. All inputs and outputs are synchronized with the rising edge of the clock input. The data paths are internally pipelined to achieve very high bandwidth. All input and output voltage levels are compatible with LVTTL.

Programmable options include the length of pipeline (Read latency of 2 or 3), the number of consecutive read or write cycles initiated by a single control command (Burst length of 1,2,4,8 or full page), and the burst count sequence(sequential or interleave). A burst of read or write cycles in progress can be terminated by a burst terminate command or can be interrupted and replaced by a new burst read or write command on any cycle. (This pipelined design is not restricted by a '2N' rule)

FEATURES

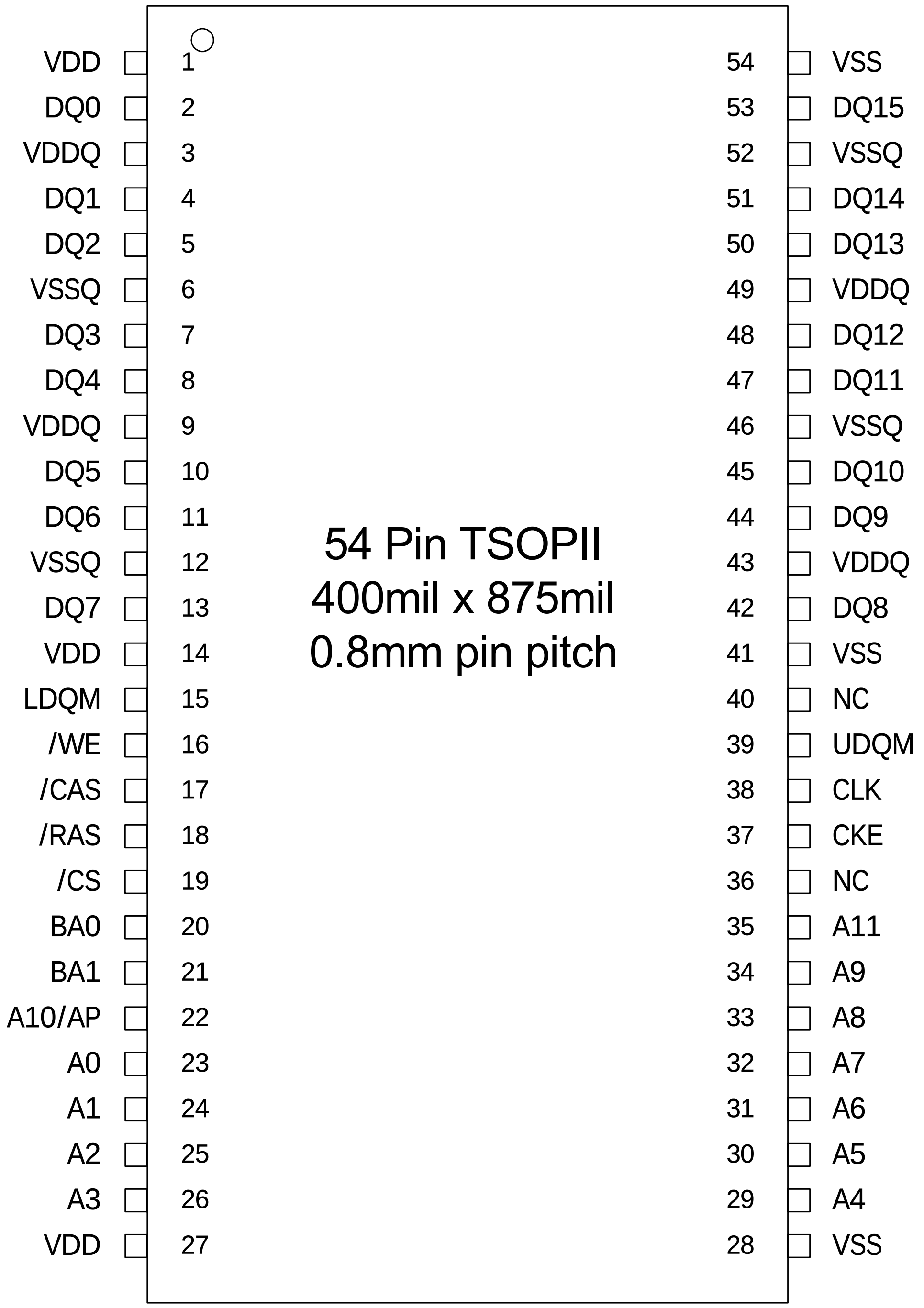
- Voltage: VDD, VDDQ 3.3V supply voltage
- All device pins are compatible with LVTTL interface
- 54 Pin TSOPII (Lead or Lead Free Package)
- All inputs and outputs referenced to positive edge of system clock
- Data mask function by UDQM, LDQM
- Internal four banks operation
- Auto refresh and self refresh
- 4096 Refresh cycles / 64ms
- Programmable Burst Length and Burst Type
  - 1, 2, 4, 8 or full page for Sequential Burst
  - 1, 2, 4 or 8 for Interleave Burst
- Programmable $\overline{CAS}$ Latency; 2, 3 Clocks
- Burst Read Single Write operation

ORDERING INFORMATION

Part No.	Clock Frequency	Organization	Interface	Package
HY57V641620E(L/S)T(P)-5I	200MHz	4Banks x 1Mbits x16	LVTTL	54 Pin TSOPII
HY57V641620E(L/S)T(P)-6I	166MHz			
HY57V641620E(L/S)T(P)-7I	143MHz			
HY57V641620E(L/S)T(P)-HI	133MHz			

Note: 1. HY57V641620ET-xI Series: Normal power, Leaded.
2. HY57V641620ELT-xI Series: Low power, Leaded.
3. HY57V641620EST-xI Series: Super Low power, Leaded.
4. HY57V641620ETP-xI Series: Normal power, Lead Free.
5. HY57V641620ELTP-xI Series: Low power, Lead Free.
6. HY57V641620ESTP-xI Series: Super Low Power, Lead Free

PIN ASSIGNMENTS

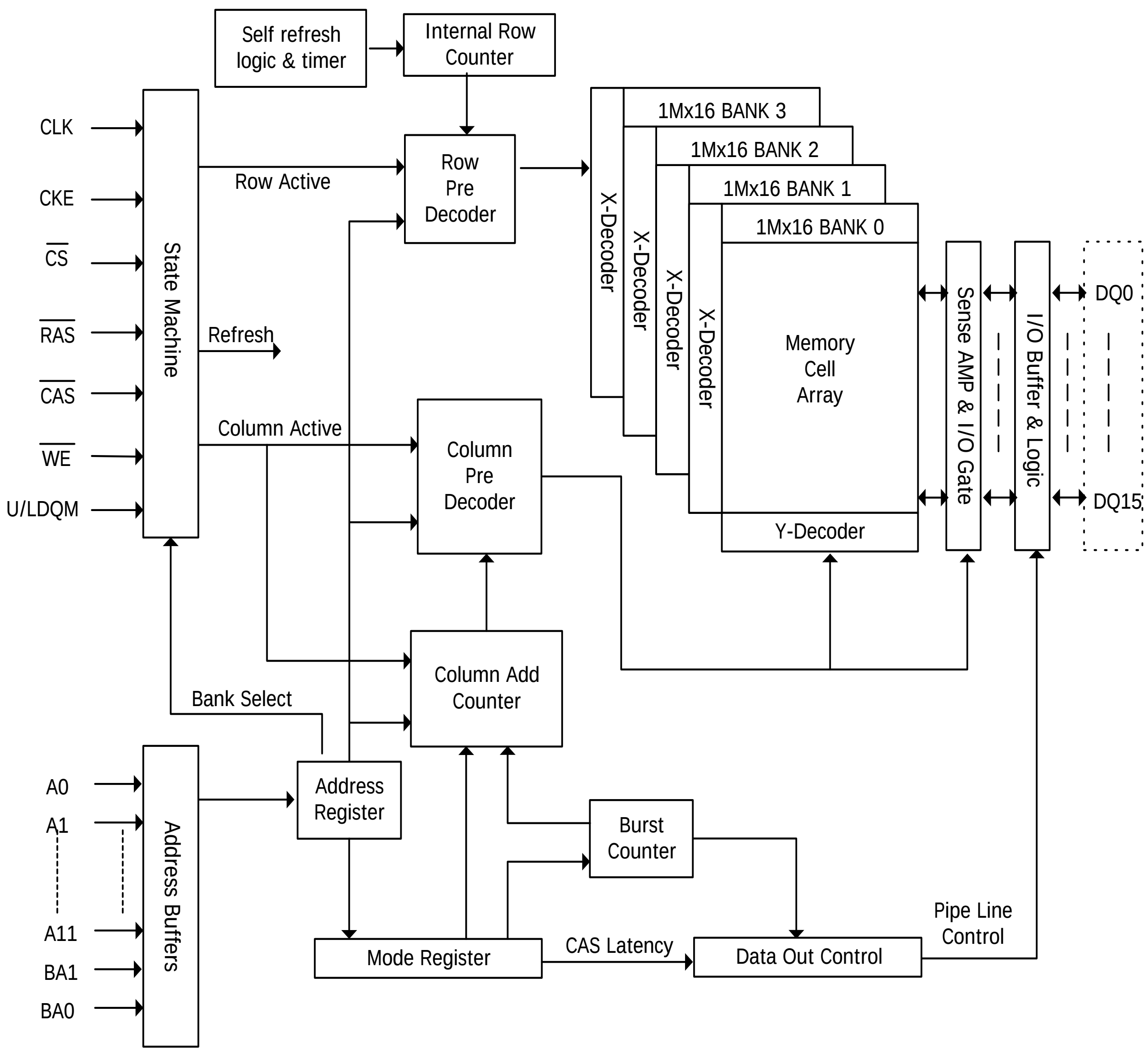


PIN DESCRIPTION

SYMBOL	TYPE	DESCRIPTION
CLK	Clock	The system clock input. All other inputs are registered to the SDRAM on the rising edge of CLK
CKE	Clock Enable	Controls internal clock signal and when deactivated, the SDRAM will be one of the states among power down, suspend or self refresh
$\overline{CS}$	Chip Select	Enables or disables all inputs except CLK, CKE, UDQM and LDQM
BA0, BA1	Bank Address	Selects bank to be activated during $\overline{RAS}$ activity Selects bank to be read/written during $\overline{CAS}$ activity
A0 ~ A11	Address	Row Address: RA0 ~ RA11, Column Address: CA0 ~ CA7 Auto-precharge flag: A10
$\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$	Row Address Strobe, Column Address Strobe, Write Enable	$\overline{RAS}$, $\overline{CAS}$ and $\overline{WE}$ define the operation Refer function truth table for details
UDQM, LDQM	Data Input/Output Mask	Controls output buffers in read mode and masks input data in write mode
DQ0 ~ DQ15	Data Input / Output	Multiplexed data input / output pin
VDD / VSS	Power Supply / Ground	Power supply for internal circuits and input buffers
VDDQ / VSSQ	Data Output Power / Ground	Power supply for output buffers
NC	No Connection	No connection

FUNCTIONAL BLOCK DIAGRAM

1Mbit x 4banks x 16 I/O Synchronous DRAM



S29AL016D

16 Megabit (2 M x 8-Bit/1 M x 16-Bit) CMOS 3.0 Volt-only Boot Sector Flash Memory

SPANSION™

Data Sheet

PRELIMINARY

Distinctive Characteristics

Architectural Advantages

- **Single power supply operation**
  - Full voltage range: 2.7 to 3.6 volt read and write operations for battery-powered applications
- **Manufactured on 200nm process technology**
  - Fully compatible with 0.23 µm Am29LV160D and MBM29LV160E devices
- **Flexible sector architecture**
  - One 16 Kbyte, two 8 Kbyte, one 32 Kbyte, and thirty-one 64 Kbyte sectors (byte mode)
  - One 8 Kword, two 4 Kword, one 16 Kword, and thirty-one 32 Kword sectors (word mode)
- **Sector Protection features**
  - A hardware method of locking a sector to prevent any program or erase operations within that sector
  - Sectors can be locked in-system or via programming equipment
  - Temporary Sector Unprotect feature allows code changes in previously locked sectors
- **Unlock Bypass Program Command**
  - Reduces overall programming time when issuing multiple program command sequences
- **Top or bottom boot block configurations available**
- **Compatibility with JEDEC standards**
  - Pinout and software compatible with single-power supply Flash
  - Superior inadvertent write protection

Performance Characteristics

- **High performance**
  - Access times as fast as 70 ns
- **Ultra low power consumption (typical values at 5 MHz)**
  - 200 nA Automatic Sleep mode current
  - 200 nA standby mode current
  - 9 mA read current
  - 20 mA program/erase current
- **Cycling endurance: 1,000,000 cycles per sector typical**
- **Data retention: 20 years typical**

Package Options

- **48-ball FBGA**
- **48-pin TSOP**
- **44-pin SOP**

Software Features

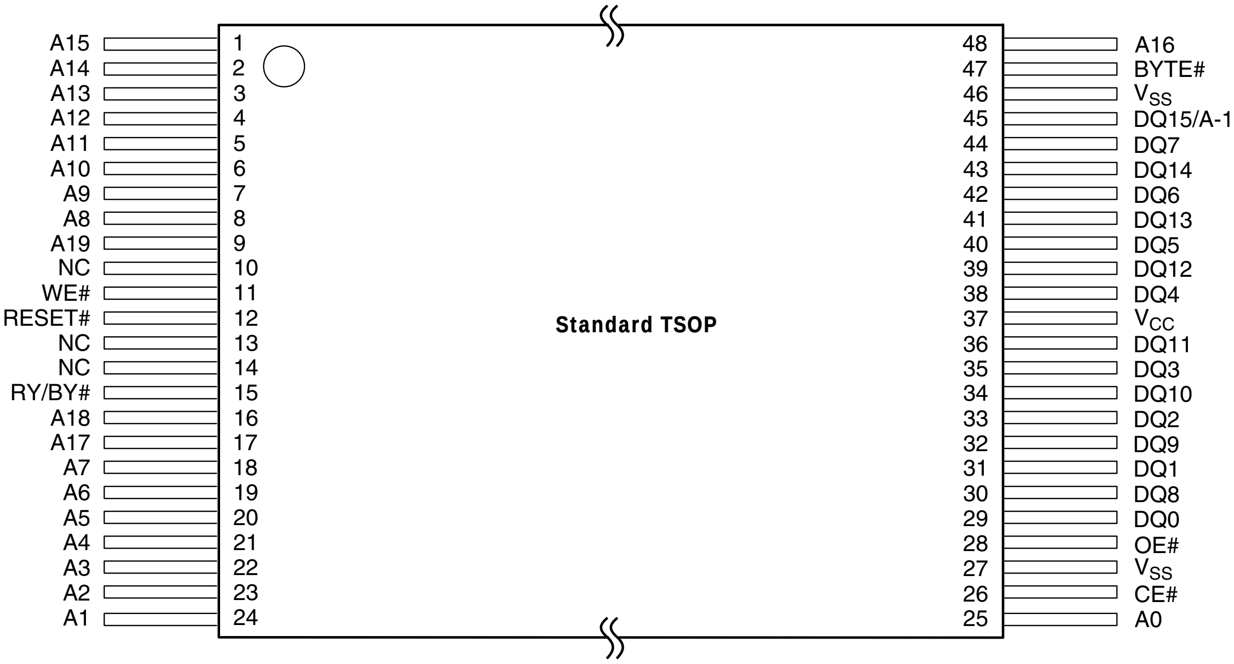
- **CFI (Common Flash Interface) compliant**
  - Provides device-specific information to the system, allowing host software to easily reconfigure for different Flash devices
- **Erase Suspend/Erase Resume**
  - Suspends an erase operation to read data from, or program data to, a sector that is not being erased, then resumes the erase operation
- **Data# Polling and toggle bits**
  - Provides a software method of detecting program or erase operation completion

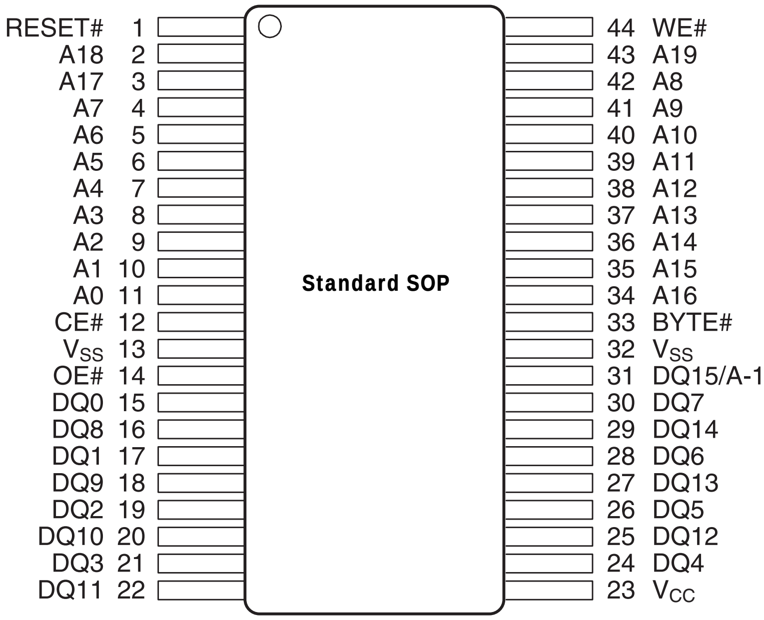
Hardware Features

- **Ready/Busy# pin (RY/BY#)**
  - Provides a hardware method of detecting program or erase cycle completion

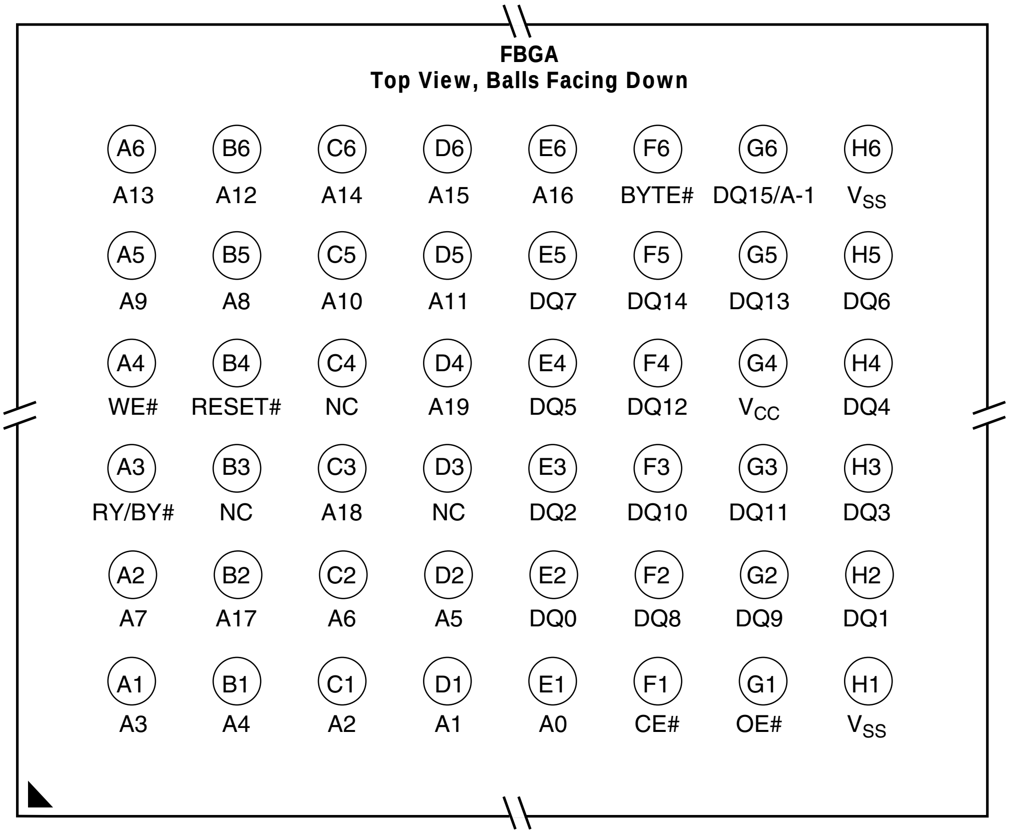
Publication Number S29AL016D_00 **Revision** A **Amendment** 2 **Issue Date** December 17, 2004

Connection Diagrams





Connection Diagrams



Special Handling Instructions

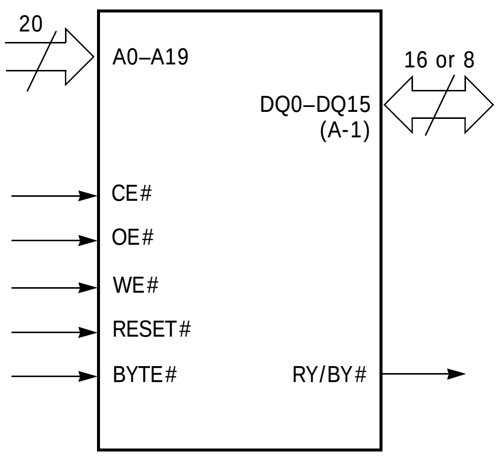
Special handling is required for Flash Memory products in FBGA packages.

Flash memory devices in FBGA packages may be damaged if exposed to ultrasonic cleaning methods. The package and/or data integrity may be compromised if the package body is exposed to temperatures above 150°C for prolonged periods of time.

Pin Configuration

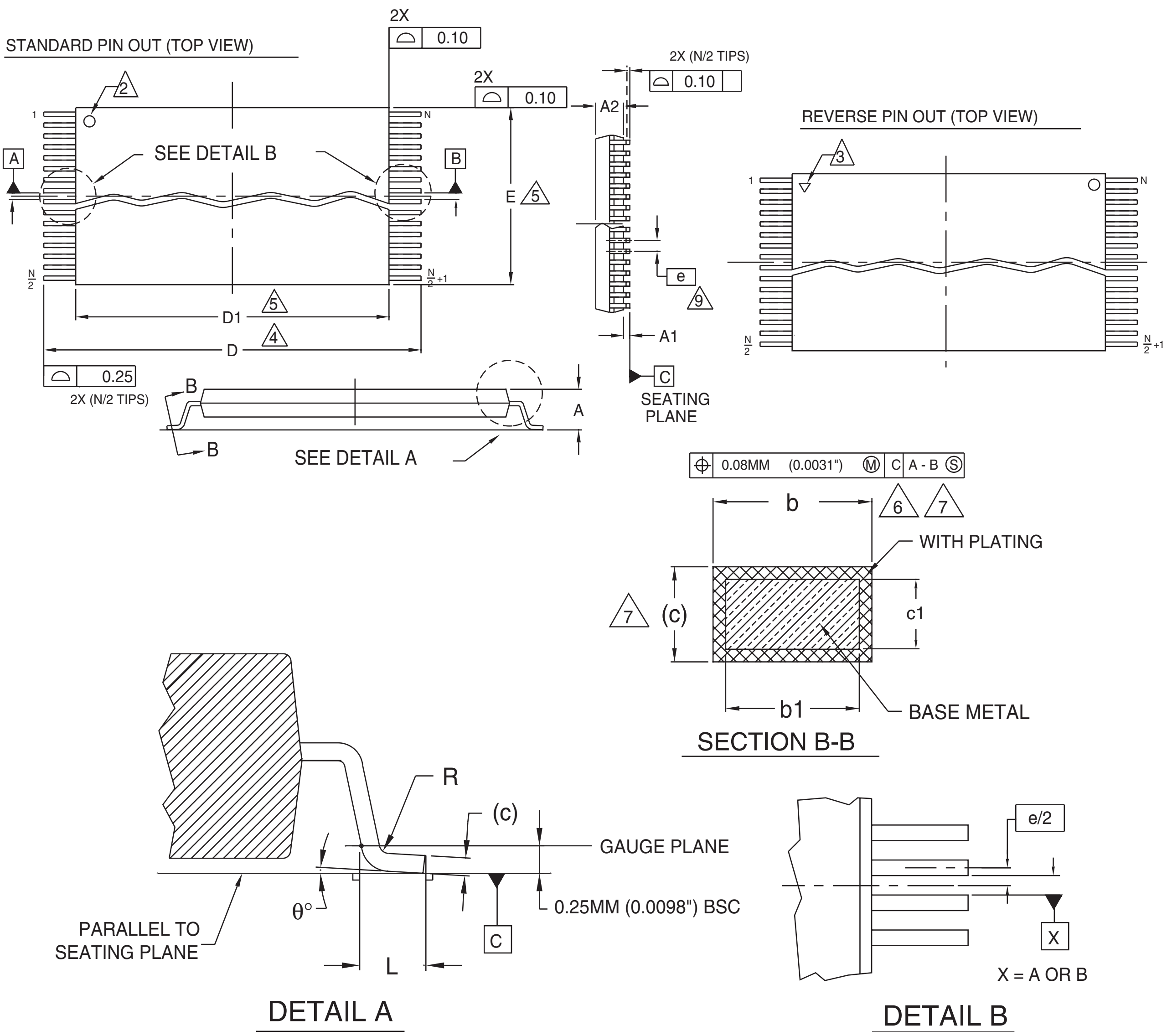
A0–A19	=	20 addresses
DQ0–DQ14	=	15 data inputs/outputs
DQ15/A-1	=	DQ15 (data input/output, word mode), A-1 (LSB address input, byte mode)
BYTE#	=	Selects 8-bit or 16-bit mode
CE#	=	Chip enable
OE#	=	Output enable
WE#	=	Write enable
RESET#	=	Hardware reset pin
RY/BY#	=	Ready/Busy output
V_{CC}	=	3.0 volt-only single power supply (see Product Selector Guide for speed options and voltage supply tolerances)
V_{SS}	=	Device ground
NC	=	Pin not connected internally

Logic Symbol



Physical Dimensions

TS 048—48-Pin Standard TSOP



Jedec	MO-142 (D) DD		
Symbol	MIN	NOM	MAX
A	—	—	1.20
A1	0.05	—	0.15
A2	0.95	1.00	1.05
b1	0.17	0.20	0.23
b	0.17	0.22	0.27
c1	0.10	—	0.16
c	0.10	—	0.21
D	19.80	20.00	20.20
D1	18.30	18.40	18.50
E	11.90	12.00	12.10
e	0.50 BASIC		
L	0.50	0.60	0.70
θ	0˚	—	8˚
R	0.08	—	0.20
N	48		

NOTES:

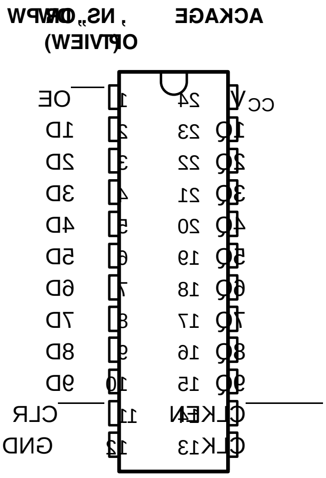
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (mm). (DIMENSIONING AND TOLERANCING CONFORMS TO ANSI Y14.5M-1982)
2. PIN 1 IDENTIFIER FOR REVERSE PIN OUT (DIE UP).
3. PIN 1 IDENTIFIER FOR REVERSE PIN OUT (DIE DOWN), INK OR LASER MARK.
4. TO BE DETERMINED AT THE SEATING PLANE -C-. THE SEATING PLANE IS DEFINED AS THE PLANE OF CONTACT THAT IS MADE WHEN THE PACKAGE LEADS ARE ALLOWED TO REST FREELY ON A FLAT HORIZONTAL SURFACE.
5. DIMENSIONS D1 AND E DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTUSION IS 0.15mm (.0059") PER SIDE.
6. DIMENSION b DOES NOT INCLUDE DAMBAR PROTUSION. ALLOWABLE DAMBAR PROTUSION SHALL BE 0.08 (0.0031") TOTAL IN EXCESS OF b DIMENSION AT MAX. MATERIAL CONDITION. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.07 (0.0028").
7. THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10MM (.0039") AND 0.25MM (0.0098") FROM THE LEAD TIP.
8. LEAD COPLANARITY SHALL BE WITHIN 0.10mm (0.004") AS MEASURED FROM THE SEATING PLANE.
9. DIMENSION "e" IS MEASURED AT THE CENTERLINE OF THE LEADS.

3355 \ 16-038.10c

** For reference only. BSC is an ANSI standard for Basic Space Centering.*

FEATURES

- Operates From 1.65 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max t_{pd} of 7.9 ns at 3.3 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at V_{CC} = 3.3 V, T_A = 25°C
- Typical V_{OHV} (Output V_{OH} Undershoot) >2 V at V_{CC} = 3.3 V, T_A = 25°C
- Supports Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V V_{CC})
- I_{off} Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - – 2000-V Human-Body Model (A114-A)
  - – 200-V Machine Model (A115-A)
  - – 1000-V Charged-Device Model (C101)



DESCRIPTION/ORDERING INFORMATION

This 9-bit bus-interface flip-flop is designed for 1.65-V to 3.6-V V_{CC} operation.

The SN74LVC823A is designed specifically for driving highly capacitive or relatively low-impedance loads. It is particularly suitable for implementing wider buffer registers, I/O ports, bidirectional bus drivers with parity, and working registers.

With the clock-enable ($\overline{\text{CLKEN}}$) input low, the nine D-type edge-triggered flip-flops enter data on the low-to-high transitions of the clock. Taking $\overline{\text{CLKEN}}$ high disables the clock buffer, latching the outputs. This device has noninverting data (D) inputs. Taking the clear ($\overline{\text{CLR}}$) input low causes the nine Q outputs to go low, independently of the clock.

ORDERING INFORMATION

T_A	PACKAGE(1)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SOIC – DW	Tube of 25	SN74LVC823ADW	LVC823A
		Reel of 2000	SN74LVC823ADWR	
	SOP – NS	Reel of 2000	SN74LVC823ANSR	LVC823A
	SSOP – DB	Reel of 2000	SN74LVC823ADBR	LC823A
	TSSOP – PW	Tube of 60	SN74LVC823APW	LC823A
		Reel of 2000	SN74LVC823APWR	
		Reel of 250	SN74LVC823APWT	
	TVSOP – DGV	Reel of 2000	SN74LVC823ADGVR	LC823A

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

DESCRIPTION/ORDERING INFORMATION (CONTINUED)

A buffered output-enable ($\overline{OE}$) input can be used to place the nine outputs in either a normal logic state (high or low logic levels) or the high-impedance state. $\overline{OE}$ does not affect the internal operations of the latch. Previously stored data can be retained or new data can be entered while the outputs are in the high-impedance state.

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of these devices as translators in a mixed 3.3-V/5-V system environment.

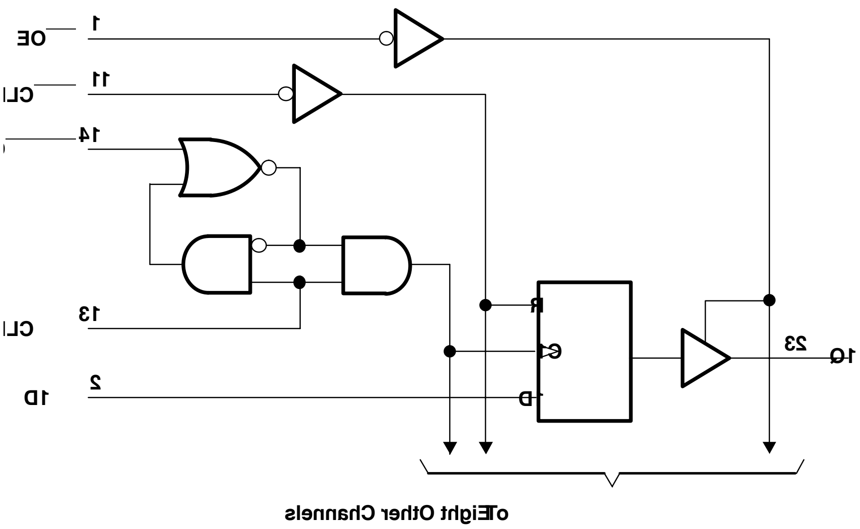
This device is fully specified for partial-power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

FUNCTION TABLE
(EACH FLIP-FLOP)

INPUTS					OUTPUT
$\overline{OE}$	$\overline{CLR}$	$\overline{CLKEN}$	CLK	D	Q
L	L	X	X	X	L
L	H	L	↑	H	H
L	H	L	↑	L	L
L	H	H	X	X	Q_0
H	X	X	X	X	Z

LOGIC DIAGRAM (POSITIVE LOGIC)

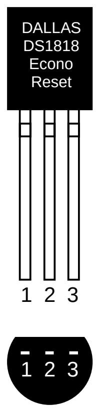


DALLAS SEMICONDUCTOR

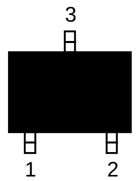
DS1818
3.3V EconoReset with Pushbutton

FEATURES
- Automatically restarts a microprocessor after power failure
- Monitors pushbutton for external override
- Maintains reset for 150 ms after V_{CC} returns to an in-tolerance condition
- Reduces need for discrete components
- Precision temperature-compensated voltage reference and voltage sensor
- Accurate 5%, 10% or 20% power monitoring
- Low-cost TO-92 or space saving surface mount SOT-23 packages available
- Efficient open-drain output with internal 5.5 kΩ pull-up resistor
- Operating temperature -40°C to +85°C

PIN ASSIGNMENT



BOTTOM VIEW
TO-92 PACKAGE
See Mech.
Drawings Section
On Website



TOP VIEW
SOT-23 PACKAGE
See Mech.
Drawings Section
On Website

PIN DESCRIPTION

TO-92

1	$\overline{RST}$	Active Low Reset Output
2	V_{CC}	Power Supply
3	GND	Ground

SOT-23

1	$\overline{RST}$	Active Low Reset Output
2	V_{CC}	Power Supply
3	GND	Ground

DESCRIPTION
The DS1818 EconoReset uses a precision temperature-compensated reference and comparator circuit to monitor the status of the power supply (V_{CC}). When an out-of-tolerance condition is detected, an internal power-fail signal is generated which forces reset to the active state. When V_{CC} returns to an in-tolerance condition, the reset signal is kept in the active state for approximately 150 ms to allow the power supply and processor to stabilize.

The DS1818 also monitors a pushbutton on the reset output. If the reset line is pulled low, a reset is generated upon release and the DS1818 output will be held in reset output low for typically 150 ms.

041002

March 1999
Revised February 2005

NC7WZ07
TinyLogic® UHS Dual Buffer (Open Drain Outputs)

General Description

The NC7WZ07 is a dual buffer with open drain outputs from Fairchild's Ultra High Speed Series of TinyLogic® in the space saving SC70 6-lead package. The device is fabricated with advanced CMOS technology to achieve ultra high speed with high output drive while maintaining low static power dissipation over a very broad V_{CC} operating range. The device is specified to operate over the 1.65V to 5.5V V_{CC} range. The inputs and outputs are high impedance when V_{CC} is 0V. Inputs tolerate voltages up to 7V independent of V_{CC} operating voltage.

Features

- Space saving SC70 6-lead package
- Ultra small MicroPak™ Pb-Free leadless package
- Ultra High Speed: t_{PZL} 2.3 ns Typ into 50 pF at 5V V_{CC}
- High I_{OL} Output Drive: +24 mA at 3V V_{CC}
- Broad V_{CC} Operating Range: 1.65V to 5.5V
- Matches the performance of LCX when operated at 3.3V V_{CC}
- Power down high impedance inputs/outputs
- Overvoltage tolerant inputs facilitate 5V to 3V translation
- Patented noise/EMI reduction circuitry implemented

Ordering Code:

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
NC7WZ07P6X	MAA06A	Z07	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
NC7WZ07P6X_NL (Note 1)	MAA06A	Z07	Pb-Free 6-Lead SC70, EIAJ SC88, 1.25mm Wide	3k Units on Tape and Reel
NC7WZ07L6X	MAC06A	D3	Pb-Free 6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

Pb-Free package per JEDEC J-STD-020B.

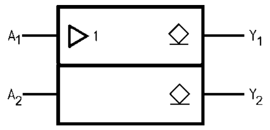
Note 1: "_NL" indicates Pb-Free product (per JEDEC J-STD-020B). Device is available in Tape and Reel only.

TinyLogic® is a registered trademark of Fairchild Semiconductor Corporation.
MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

NC7WZ07 TinyLogic® UHS Dual Buffer (Open Drain Outputs)

Logic Symbol

IEEE/IEC



Pin Descriptions

Pin Names	Description
A_1, A_2	Data Inputs
Y_1, Y_2	Output

Function Table

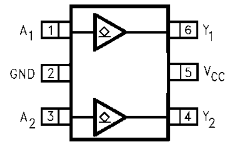
Y = A

Input	Output
A	**Y**
L	L
H	Z

H = HIGH Logic Level
L = LOW Logic Level

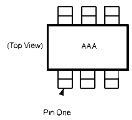
Connection Diagrams

Pin Assignments for SC70



(Top View)

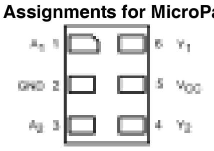
Pin One Orientation Diagram



AAA represents Product Code Top Mark - see ordering code

Note: Orientation of Top Mark determines Pin One location. Read the top product code mark left to right, Pin One is the lower left pin (see diagram).

Pad Assignments for MicroPak



(Top Thru View)

FAN1112

1A 1.2V Low Dropout Linear Regulator

Features

- Low dropout voltage
- Load regulation: 0.05% typical
- Trimmed current limit
- On-chip thermal limiting
- Standard SOT-223 and TO-252 packages
- Three-terminal fixed 1.2V

Applications

- Post regulator for switching supplies
- Supply for low-voltage processors

Description

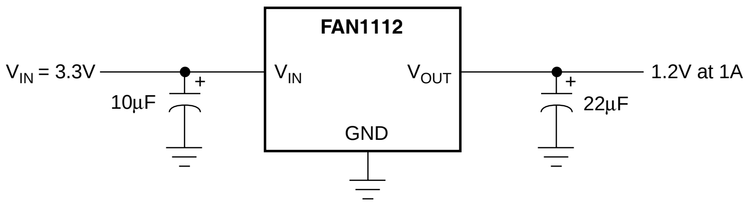
The FAN1112 is a 1.2V low dropout three-terminal regulator with 1A output current capability. The device has been optimized for low voltage where transient response and minimum input voltage are critical.

Current limit is trimmed to ensure specified output current and controlled short-circuit current. On-chip thermal limiting provides protection against any combination of overload and ambient temperatures that would create excessive junction temperatures.

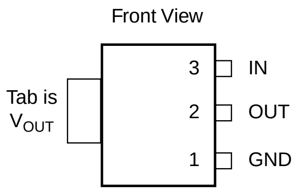
Unlike PNP type regulators where up to 10% of the output current is wasted as quiescent current, the quiescent current of the FAN1112 flows into the load, increasing efficiency.

The FAN1112 regulator is available in the industry-standard SOT-223 and TO-252 (DPAK) power packages.

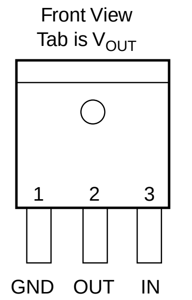
Typical Application



Pin Assignments



4-Lead Plastic SOT-223
Θ_{JC} = 15°C/W*



3-Lead Plastic TO-252
Θ_{JC} = 3°C/W*

*With package soldered to 0.5 square inch copper area over backside ground plane or internal power plane., Θ_{JA} can vary from 30°C/W to more than 50°C/W. Other mounting techniques may provide better thermal resistance than 30°C/W.

Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
V_{IN}		18	V
$(V_{IN} - V_{OUT}) * I_{OUT}$		See Figure 1	
Operating Junction Temperature Range	0	125	°C
Storage Temperature Range	-65	150	°C
Lead Temperature (Soldering, 10 sec.)		300	°C

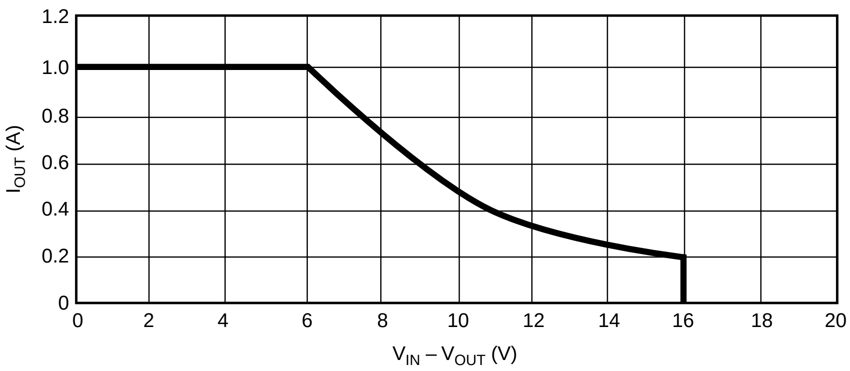


Figure 1. Absolute Maximum Safe Operating Area

PIC18F87J10 Family Data Sheet

64/80-Pin High-Performance,
1-Mbit Flash Microcontrollers
with nanoWatt Technology

PIC18F87J10 FAMILY

64/80-Pin, High-Performance, 1-Mbit Flash Microcontrollers with nanoWatt Technology

Special Microcontroller Features:

- Operating voltage range: 2.0V to 3.6V
- 5.5V tolerant input (digital pins only)
- On-chip 2.5V regulator
- Low-power, high-speed CMOS Flash technology
- C compiler optimized architecture:
  - Optional extended instruction set designed to optimize re-entrant code
- Priority levels for interrupts
- 8 x 8 Single-Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT):
  - Programmable period from 4 ms to 131s
- Single-Supply In-Circuit Serial Programming™ (ICSP™) via two pins
- In-Circuit Debug (ICD) with three Break points via two pins
- Power-Managed modes:
  - Run: CPU on, peripherals on
  - Idle: CPU off, peripherals on
  - Sleep: CPU off, peripherals off

Flexible Oscillator Structure:

- Two Crystal modes, up to 40 MHz
- 4x Phase Lock Loop (PLL)
- Two External Clock modes, up to 40 MHz
- Internal 31 kHz oscillator
- Secondary oscillator using Timer1 @ 32 kHz
- Two-Speed Oscillator Start-up
- Fail-Safe Clock Monitor:
  - Allows for safe shutdown if peripheral clock stops

Peripheral Highlights:

- High-current sink/source 25 mA/25 mA (PORTB and PORTC)
- Four programmable external interrupts
- Four input change interrupts
- Two Capture/Compare/PWM (CCP) modules
- Three Enhanced Capture/Compare/PWM (ECCP) modules:
  - One, two or four PWM outputs
  - Selectable polarity
  - Programmable dead time
  - Auto-Shutdown and Auto-Restart
- Two Master Synchronous Serial Port (MSSP) modules supporting 3-wire SPI™ (all 4 modes) and I^2C™ Master and Slave modes
- Two Enhanced Addressable USART modules:
  - Supports RS-485, RS-232 and LIN 1.2
  - Auto-Wake-up on Start bit
  - Auto-Baud Detect
- 10-bit, up to 15-channel Analog-to-Digital Converter module (A/D):
  - Auto-acquisition capability
  - Conversion available during Sleep
  - Self-calibration feature
- Dual analog comparators with input multiplexing

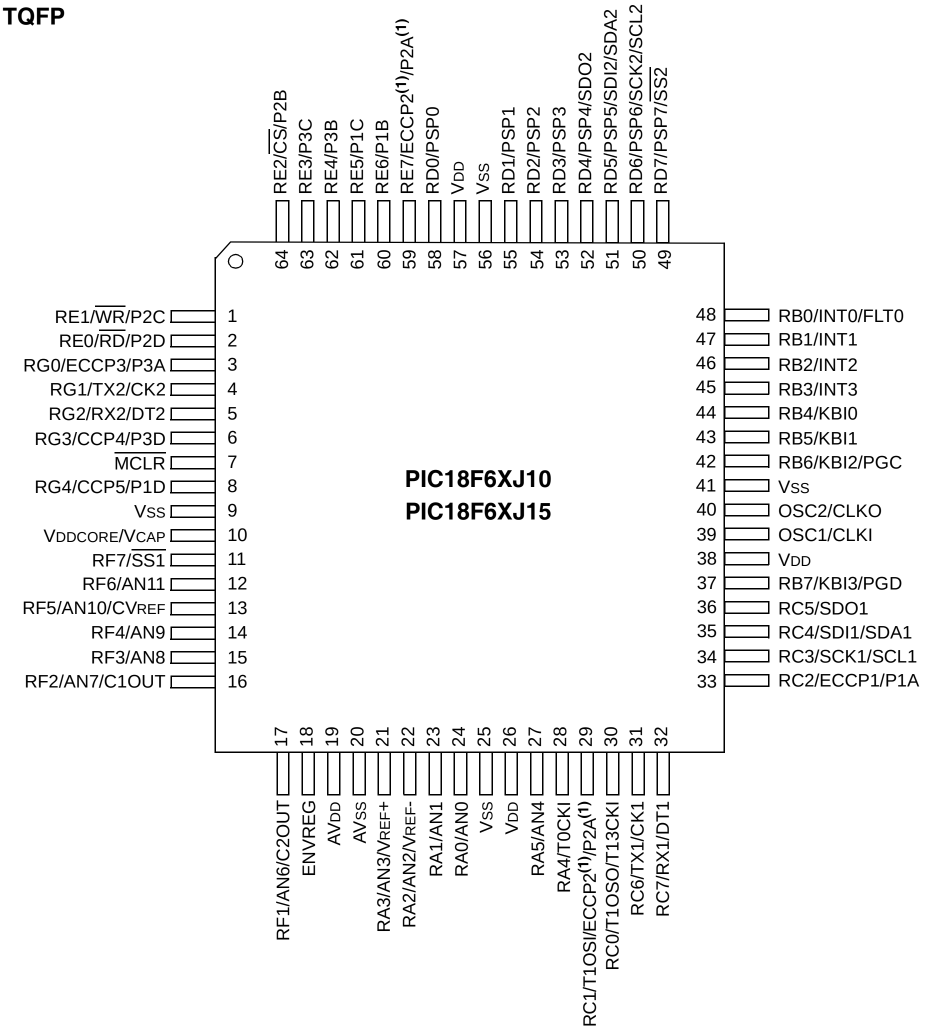
External Memory Bus (PIC18F8XJ10/8XJ15 only):

- Address capability of up to 2 Mbytes
- 8-bit or 16-bit interface
- 12-bit, 16-bit and 20-bit Addressing modes

Device	Program Memory		SRAM Data Memory (bytes)	I/O	10-bit A/D (ch)	CCP/ ECCP (PWM)	MSSP			EUSART	Comparators	Timers 8/16-bit	External Bus
	Flash (bytes)	# Single-Word Instructions						SPI™	Master I^2C™				
PIC18F65J10	32K	16384	2048	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F65J15	48K	24576	2048	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F66J10	64K	32768	2048	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F66J15	96K	49152	3936	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F67J10	128K	65536	3936	50	11	2/3	2	Y	Y	2	2	2/3	N
PIC18F85J10	32K	16384	2048	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F85J15	48K	24576	2048	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F86J10	64K	32768	2048	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F86J15	96K	49152	3936	66	15	2/3	2	Y	Y	2	2	2/3	Y
PIC18F87J10	128K	65536	3936	66	15	2/3	2	Y	Y	2	2	2/3	Y

Pin Diagrams

64-Pin TQFP



Note 1: The ECCP2/P2A pin placement depends on the setting of the CCP2MX configuration bit.

Features

- **Low-voltage and Standard-voltage Operation**
  - **– 2.7 (V_{CC} = 2.7V to 5.5V)**
  - **– 1.8 (V_{CC} = 1.8V to 5.5V)**
- **Internally Organized 128 x 8 (1K), 256 x 8 (2K), 512 x 8 (4K), 1024 x 8 (8K) or 2048 x 8 (16K)**
- **Two-wire Serial Interface**
- **Schmitt Trigger, Filtered Inputs for Noise Suppression**
- **Bidirectional Data Transfer Protocol**
- **100 kHz (1.8V) and 400 kHz (2.5V, 2.7V, 5V) Compatibility**
- **Write Protect Pin for Hardware Data Protection**
- **8-byte Page (1K, 2K), 16-byte Page (4K, 8K, 16K) Write Modes**
- **Partial Page Writes Allowed**
- **Self-timed Write Cycle (5 ms max)**
- **High-reliability**
  - **– Endurance: 1 Million Write Cycles**
  - **– Data Retention: 100 Years**
- **Automotive Grade, Extended Temperature and Lead-free/Halogen-free Devices Available**
- **8-lead PDIP, 8-lead JEDEC SOIC, 8-lead MAP, 5-lead SOT23, 8-lead TSSOP and 8-ball dBGA2 Packages**
- **Die Sales: Wafer Form, Waffle Pack and Bumped Wafers**

Two-wire Serial EEPROM

1K (128 x 8)

2K (256 x 8)

4K (512 x 8)

8K (1024 x 8)

16K (2048 x 8)

AT24C01A
AT24C02
AT24C04
AT24C08(1)
AT24C16(2)

Note: 1. This device is not recommended for new designs. Please refer to AT24C08A.

2. This device is not recommended for new designs. Please refer to AT24C16A.

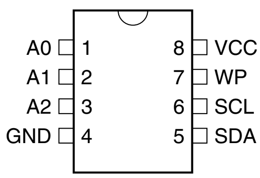
Description

The AT24C01A/02/04/08/16 provides 1024/2048/4096/8192/16384 bits of serial electrically erasable and programmable read-only memory (EEPROM) organized as 128/256/512/1024/2048 words of 8 bits each. The device is optimized for use in many industrial and commercial applications where low-power and low-voltage operation are essential. The AT24C01A/02/04/08/16 is available in space-saving 8-lead PDIP, 8-lead JEDEC SOIC, 8-lead MAP, 5-lead SOT23 (AT24C01A/AT24C02/AT24C04), 8-lead TSSOP, and 8-ball dBGA2 packages and is accessed via a Two-wire serial interface. In addition, the entire family is available in 2.7V (2.7V to 5.5V) and 1.8V (1.8V to 5.5V) versions.

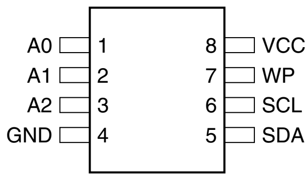
Table 1. Pin Configuration

Pin Name	Function
A0 - A2	Address Inputs
SDA	Serial Data
SCL	Serial Clock Input
WP	Write Protect
NC	No Connect
GND	Ground
VCC	Power Supply

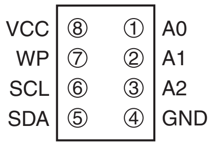
8-lead TSSOP



8-lead SOIC

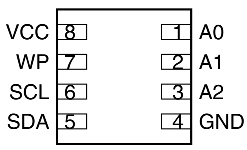


8-ball dBGA2



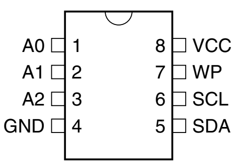
Bottom View

8-lead MAP

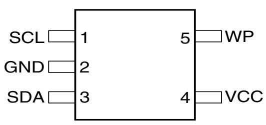


Bottom View

8-lead PDIP



5-lead SOT23

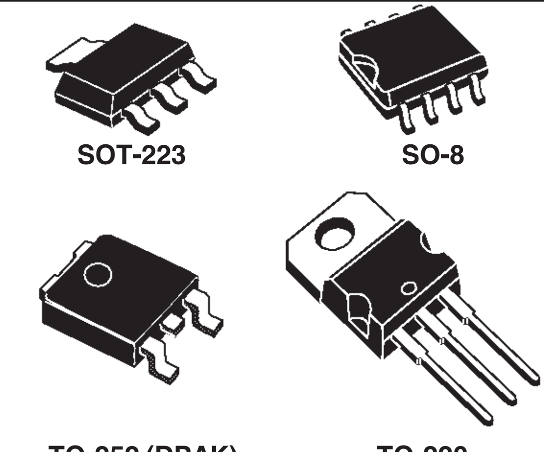


0180T–SEEPR–12/04

LD1117 SERIES

LOW DROP FIXED AND ADJUSTABLE POSITIVE VOLTAGE REGULATORS

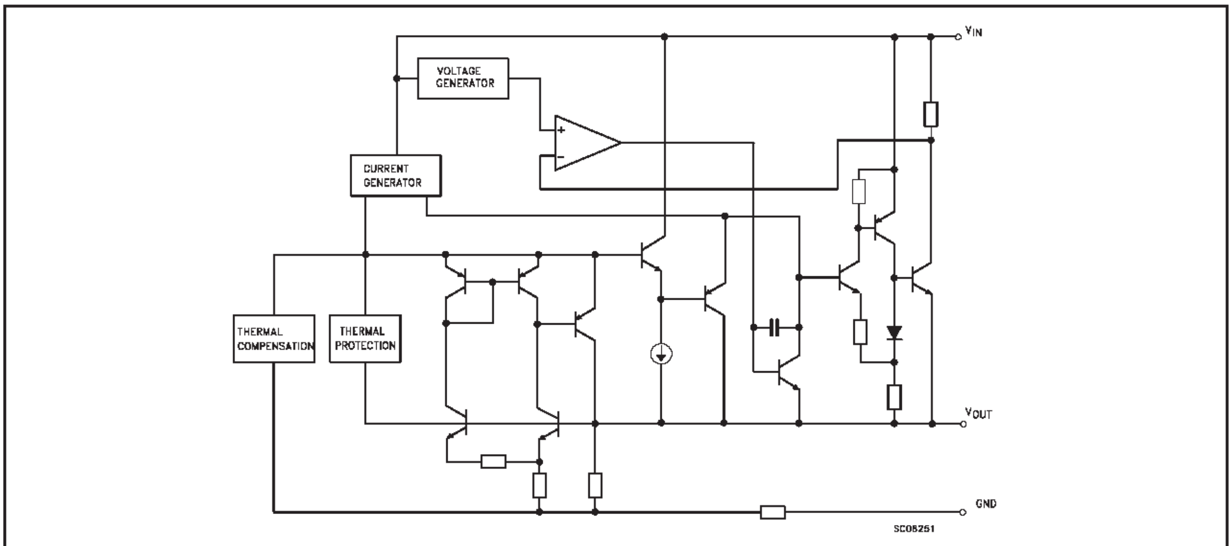
- LOW DROPOUT VOLTAGE (1V TYP)
- 2.85V DEVICE PERFORMANCES ARE SUITABLE FOR SCSI-2 ACTIVE TERMINATION
- OUTPUT CURRENT UP TO 800mA
- FIXED OUTPUT VOLTAGE OF: 1.8V, 2.5V, 2.85V, 3.0V, 3.3V, 5.0V
- ADJUSTABLE VERSION AVAILABILITY (V_{ref}=1.25V)
- INTERNAL CURRENT AND THERMAL LIMIT
- AVAILABLE IN ± 1% (AT 25°C) AND 2% IN FULL TEMPERATURE RANGE
- SUPPLY VOLTAGE REJECTION : 75 dB (TYP)
- TEMPERATURE RANGE : 0°C TO 125°C



DESCRIPTION

The LD1117 is a LOW DROP Voltage Regulator able to provide up to 800mA of Output Current, available even in adjustable version (V_{ref}=1.25V). Concerning fixed versions, are offered the following Output Voltages: 2.5V, 2.85V, 3.0V 3.3V and 5.0V. The 2.85V type is ideal for SCSI-2 lines active termination. The device is supplied in: SOT-223, DPAK, SO-8 and TO-220. The SOT-223 and DPAK surface mount packages optimize the thermal characteristics even offering a relevant space saving effect. High efficency is assured by NPN pass transistor. In fact in this case, unlike than PNP one, the Quiescent Current flows mostly into the load. Only a very common 10µF minimum capacitor is needed for stability. On chip trimming allows the regulator to reach a very tight output voltage tolerance, within ± 1% at 25 ^{o}C. The ADJUSTABLE LD1117 is pin to pin compatible with the other standard Adjustable voltage regulators maintaining the better performances in terms of Drop and Tolerance.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

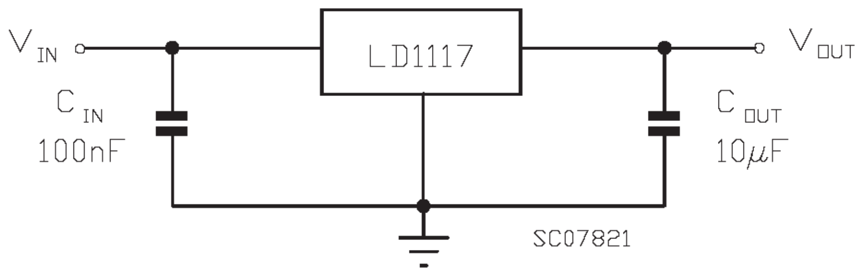
Symbol	Parameter	Value	Unit
V_{IN}	DC Input Voltage	15	V
P_{tot}	Power Dissipation	12	W
T_{stg}	Storage Temperature Range	-40 to 150	^oC
T_{op}	Operating Junction Temperature Range	0 to 125	^oC

Absolute Maximum Ratings are those value beyond which damage to the device may occur. Functional operation under these condition is not implied. Over the above suggested Max Power Dissipation a Short Circuit could definetively damage the device.

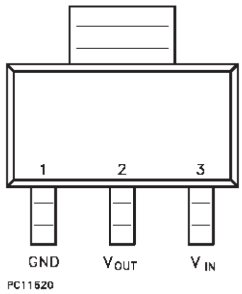
THERMAL DATA

Symbol	Parameter	SOT-223	SO-8	DPAK	TO-220	Unit
$R_{thj-case}$	Thermal Resistance Junction-case	15	20	8	3	$^oC/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient				50	$^oC/W$

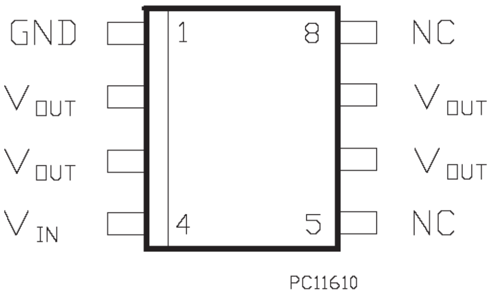
APPLICATION CIRCUIT



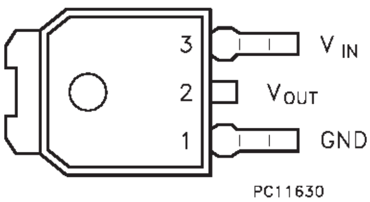
CONNECTION DIAGRAM AND ORDERING NUMBERS (top view)



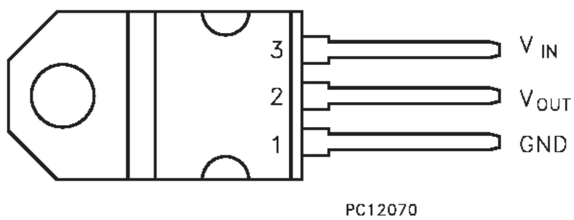
SOT-223



SO-8



DPAK



TO-220

SOT-223	SO-8	DPAK	TO-220	Output Voltage
LD1117S18	LD1117D18	LD1117DT18	LD1117V18	1.8V
LD1117S18C	LD1117D18C	LD1117DT18C	LD1117V18C	1.8V
LD1117S25	LD1117D25	LD1117DT25	LD1117V25	2.5V
LD1117S25C	LD1117D25C	LD1117DT25C	LD1117V25C	2.5V
LD1117S28	LD1117D28	LD1117DT28	LD1117V28	2.85V
LD1117S30	LD1117D30	LD1117DT30	LD1117V30	3V
LD1117S30C	LD1117D30C	LD1117DT30C	LD1117V30C	3V
LD1117S33	LD1117D33	LD1117DT33	LD1117V33	3.3V
LD1117S33C	LD1117D33C	LD1117DT33C	LD1117V33C	3.3V
LD1117S50	LD1117D50	LD1117DT50	LD1117V50	5V
LD1117S50C	LD1117D50C	LD1117DT50C	LD1117V50C	5V
LD1117S	LD1117D	LD1117DT	LD1117V	ADJUSTABLE FROM 1.25 TO 15V

KA78XX/KA78XXA

3-Terminal 1A Positive Voltage Regulator

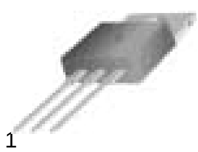
Features

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

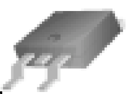
Description

The KA78XX/KA78XXA series of three-terminal positive regulator are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

TO-220

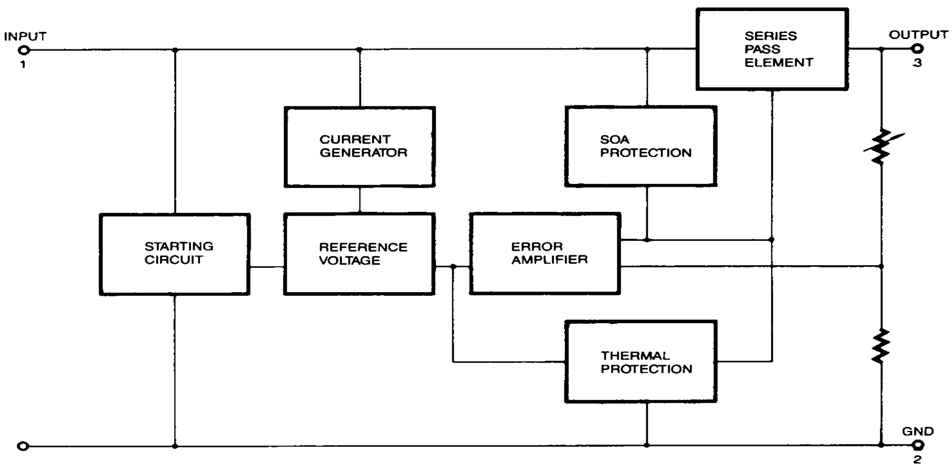


D-PAK



1. Input 2. GND 3. Output

Internal Block Digram



Rev. 1.0.0

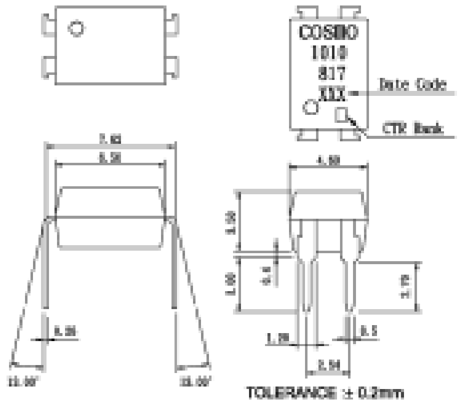
cosmo **High Reliability Photo Coupler** **K1010**

UL 1577 (File No.E169586) VDE 0884 / 0860 / 0805 (File No.101347)

Features

1. Current transfer ratio
   (CTR:MIN.50% at IF=5mA Vce=5V)
2. High isolation voltage between input and output
   (Viso:5000Vrms).
3. Compact dual-in-line package.
4. Available package : DIP/ SMD/ H.

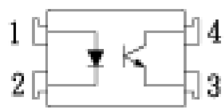
Outside Dimension : Unit (mm)



Applications

1. Registers, copiers, automatic vending machines.
2. System appliances, measuring instruments.
3. Computer terminals, programmable controllers.
4. Communications, telephone, etc.
5. Electric home appliances, such as oil fan heaters, Microwave oven, Washer, Refrigerator, Air conditioner, etc.
6. Medical instruments, physical and chemical equipment.
7. Signal transmission between circuits of different potentials and impedances.
8. Facsimile equipment, Audio, Video.
9. Switching power supply, Laser beam printer.

Schematic : Top View



1. Anode
2. Cathode
3. Emitter
4. Collector

Absolute Maximum Ratings

(Ta=25°C)

	Parameter	Symbol	Rating	Unit
Input	Forward current	IF	50	mA
	Peak forward current	IFM	1	A
	Reverse voltage	VR	6	V
	Power dissipation	PD	70	mW
Output	Collector-emitter voltage	VCEO	80	V
	Emitter-collector voltage	VECO	6	V
	Collector current	IC	50	mA
	Collector power dissipation	PC	150	mW
	Total power dissipation	Ptot	200	mW
	Isolation voltage 1 minute	Viso	5000	Vrms
	Operating temperature	Topr	-30 to +100	°C
	Storage temperature	Tstg	-55 to +125	°C
	Soldering temperature 10 second	Tsol	260	°C

Electro-optical Characteristics

(Ta=25°C)

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input	Forward voltage	VF	IF =20mA	—	1.2	1.4	V
	Peak forward voltage	VFM	IFM =0.5A	—	—	3.0	V
	Reverse current	IR	VR =4V	—	—	10	uA
	Terminal capacitance	Ct	V=0, f=1kHz	—	30	—	pF
Output	Collector dark current	ICEO	VCE =20V	—	—	0.1	uA
Transfer characteristics	Current transfer ratio	CTR	IF=5mA, VCE =5V	50	—	600	%
	Collector-emitter saturation voltage	VCE(sat)	IF=20mA, IC=1mA	—	0.1	0.2	V
	Isolation resistance	Riso	DC500V	$5X10^{10}$	10^{11}	—	ohm
	Floating capacitance	Cf	V=0, f=1MHz	—	0.6	1.0	pF
	Cut-off frequency	fc	VCC=5V, IC=2mA, RL=100ohm	—	80	—	kHz
	Response time(Rise)	tr	VCE=2V, IC=2mA, RL=100ohm	—	4	18	us
	Response time(Fall)	tf		—	3	18	us

19-4323; Rev 10; 8/01

+5V-Powered, Multichannel RS-232 Drivers/Receivers

MAX220–MAX249

General Description

The MAX220–MAX249 family of line drivers/receivers is intended for all EIA/TIA-232E and V.28/V.24 communications interfaces, particularly applications where ±12V is not available.

These parts are especially useful in battery-powered systems, since their low-power shutdown mode reduces power dissipation to less than 5μW. The MAX225, MAX233, MAX235, and MAX245/MAX246/MAX247 use no external components and are recommended for applications where printed circuit board space is critical.

Applications

Portable Computers

Low-Power Modems

Interface Translation

Battery-Powered RS-232 Systems

Multidrop RS-232 Networks

Features

Superior to Bipolar

- ♦ **Operate from Single +5V Power Supply (+5V and +12V—MAX231/MAX239)**
- ♦ **Low-Power Receive Mode in Shutdown (MAX223/MAX242)**
- ♦ **Meet All EIA/TIA-232E and V.28 Specifications**
- ♦ **Multiple Drivers and Receivers**
- ♦ **3-State Driver and Receiver Outputs**
- ♦ **Open-Line Detection (MAX243)**

Ordering Information

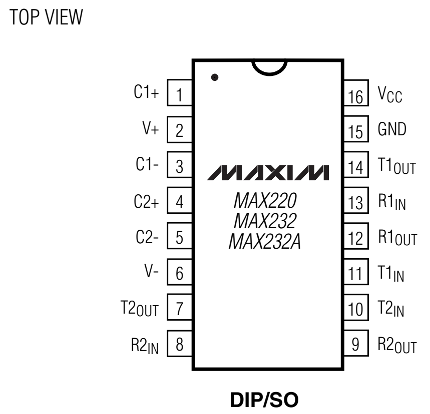
PART	TEMP. RANGE	PIN-PACKAGE
MAX220CPE	0°C to +70°C	16 Plastic DIP
MAX220CSE	0°C to +70°C	16 Narrow SO
MAX220CWE	0°C to +70°C	16 Wide SO
MAX220C/D	0°C to +70°C	Dice*
MAX220EPE	-40°C to +85°C	16 Plastic DIP
MAX220ESE	-40°C to +85°C	16 Narrow SO
MAX220EWE	-40°C to +85°C	16 Wide SO
MAX220EJE	-40°C to +85°C	16 CERDIP
MAX220MJE	-55°C to +125°C	16 CERDIP

Ordering Information continued at end of data sheet.

**Contact factory for dice specifications.*

Selection Table

Part Number	Power Supply (V)	No. of RS-232 Drivers/Rx	No. of Ext. Caps	Nominal Cap. Value (μF)	SHDN & Three-State	Rx Active in SHDN	Data Rate (kbps)	Features
MAX220	+5	2/2	4	0.1	No	—	120	Ultra-low-power, industry-standard pinout
MAX222	+5	2/2	4	0.1	Yes	—	200	Low-power shutdown
MAX223 (MAX213)	+5	4/5	4	1.0 (0.1)	Yes	✔	120	MAX241 and receivers active in shutdown
MAX225	+5	5/5	0	—	Yes	✔	120	Available in SO
MAX230 (MAX200)	+5	5/0	4	1.0 (0.1)	Yes	—	120	5 drivers with shutdown
MAX231 (MAX201)	+5 and +7.5 to +13.2	2/2	2	1.0 (0.1)	No	—	120	Standard +5/+12V or battery supplies; same functions as MAX232
MAX232 (MAX202)	+5	2/2	4	1.0 (0.1)	No	—	120 (64)	Industry standard
MAX232A	+5	2/2	4	0.1	No	—	200	Higher slew rate, small caps
MAX233 (MAX203)	+5	2/2	0	—	No	—	120	No external caps
MAX233A	+5	2/2	0	—	No	—	200	No external caps, high slew rate
MAX234 (MAX204)	+5	4/0	4	1.0 (0.1)	No	—	120	Replaces 1488
MAX235 (MAX205)	+5	5/5	0	—	Yes	—	120	No external caps
MAX236 (MAX206)	+5	4/3	4	1.0 (0.1)	Yes	—	120	Shutdown, three state
MAX237 (MAX207)	+5	5/3	4	1.0 (0.1)	No	—	120	Complements IBM PC serial port
MAX238 (MAX208)	+5	4/4	4	1.0 (0.1)	No	—	120	Replaces 1488 and 1489
MAX239 (MAX209)	+5 and +7.5 to +13.2	3/5	2	1.0 (0.1)	No	—	120	Standard +5/+12V or battery supplies; single-package solution for IBM PC serial port
MAX240	+5	5/5	4	1.0	Yes	—	120	DIP or flatpack package
MAX241 (MAX211)	+5	4/5	4	1.0 (0.1)	Yes	—	120	Complete IBM PC serial port
MAX242	+5	2/2	4	0.1	Yes	✔	200	Separate shutdown and enable
MAX243	+5	2/2	4	0.1	No	—	200	Open-line detection simplifies cabling
MAX244	+5	8/10	4	1.0	No	—	120	High slew rate
MAX245	+5	8/10	0	—	Yes	✔	120	High slew rate, int. caps, two shutdown modes
MAX246	+5	8/10	0	—	Yes	✔	120	High slew rate, int. caps, three shutdown modes
MAX247	+5	8/9	0	—	Yes	✔	120	High slew rate, int. caps, nine operating modes
MAX248	+5	8/8	4	1.0	Yes	✔	120	High slew rate, selective half-chip enables
MAX249	+5	6/10	4	1.0	Yes	✔	120	Available in quad flatpack package



CAPACITANCE (μF)					
DEVICE	C1	C2	C3	C4	C5
MAX220	4.7	4.7	10	10	4.7
MAX232	1.0	1.0	1.0	1.0	1.0
MAX232A	0.1	0.1	0.1	0.1	0.1

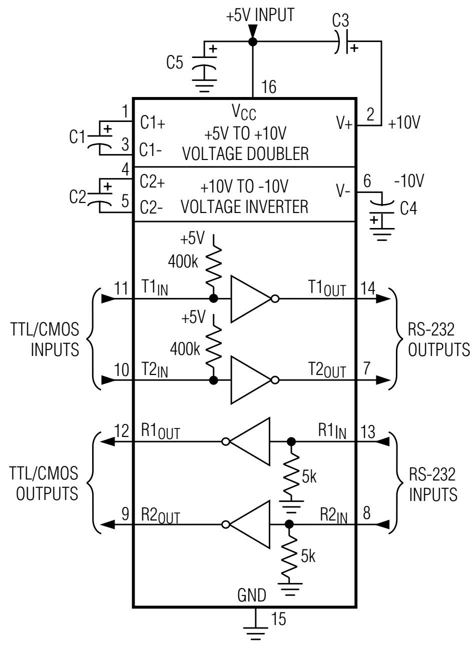
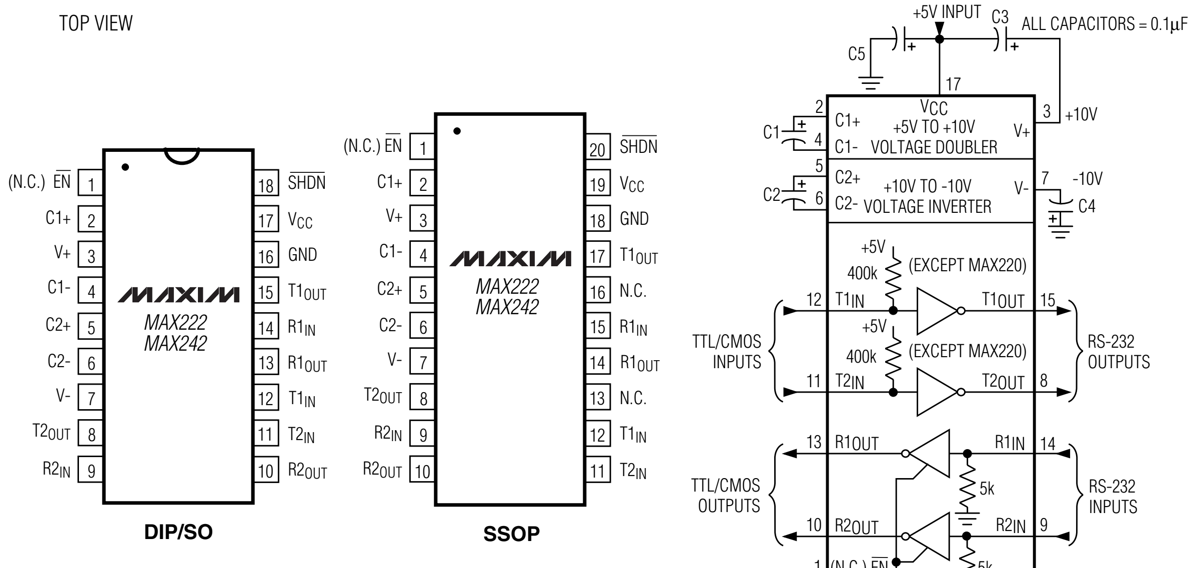


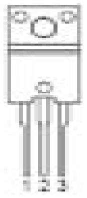
Figure 5. MAX220/MAX232/MAX232A Pin Configuration and Typical Operating Circuit



( ) ARE FOR MAX222 ONLY.
PIN NUMBERS IN TYPICAL OPERATING CIRCUIT ARE FOR DIP/SO PACKAGES ONLY.

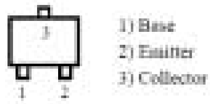
Figure 6. MAX222/MAX242 Pin Configurations and Typical Operating Circuit

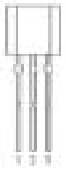
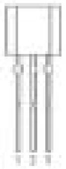
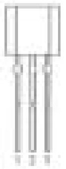
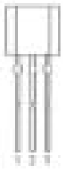
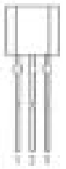
2SC2073



1. BASE
2. COLLECTOR
3. EMITTER

2SC2406



2SC1815	2SA950	2SC2458	2SC2235	2SC2120
				
1. EMITTER 2. COLLECTOR 3. BASE	1. EMITTER 2. COLLECTOR 3. BASE	1. EMITTER 2. COLLECTOR 3. BASE	1. EMITTER 2. COLLECTOR 3. BASE	1. EMITTER 2. COLLECTOR 3. BASE

Low Cost, General-Purpose High Speed JFET Amplifier

AD825

FEATURES

High speed
- **41 MHz, −3 dB bandwidth**
- **125 V/μs slew rate**
- **80 ns settling time**

Input bias current of 20 pA and noise current of 10 fA/√Hz
Input voltage noise of 12 nV/√Hz
Fully specified power supplies: ±5 V to ±15 V
Low distortion: −76 dB at 1 MHz
High output drive capability
- **Drives unlimited capacitance load**
- **50 mA min output current**

No phase reversal when input is at rail
Available in 8-lead SOIC

APPLICATIONS

CCDs
Low distortion filters
Mixed gain stages
Audio amplifiers
Photo detector interfaces
ADC input buffers
DAC output buffers

GENERAL DESCRIPTION

The AD825 is a superbly optimized operational amplifier for high speed, low cost, and dc parameters, making it ideally suited for a broad range of signal conditioning and data acquisition applications. The ac performance, gain, bandwidth, slew rate, and drive capability are all very stable over temperature. The AD825 also maintains stable gain under varying load conditions.

The unique input stage has ultralow input bias current and input current noise. Signals that go to either rail on this high performance input do not cause phase reversals at the output. These features make the AD825 a good choice as a buffer for MUX outputs, creating minimal offset and gain errors.

The AD825 is fully specified for operation with dual ±5 V and ±15 V supplies. This power supply flexibility, and the low supply current of 6.5 mA with excellent ac characteristics under all supply conditions, makes the AD825 well-suited for many demanding applications.

CONNECTION DIAGRAMS

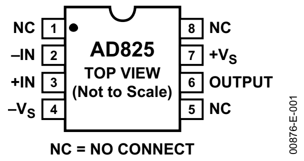


Figure 1. 8-Lead Plastic SOIC (R) Package

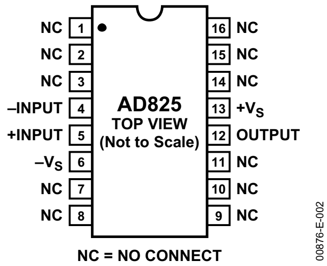


Figure 2. 16-Lead Plastic SOIC (R-16) Package

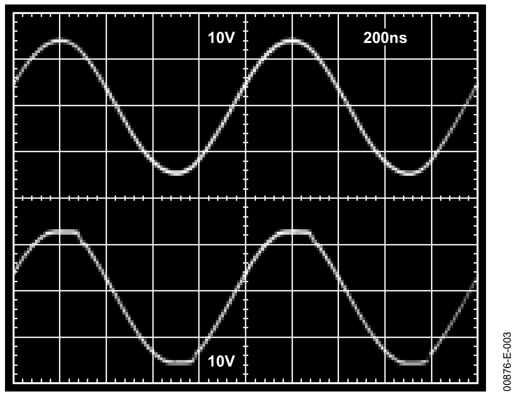


Figure 3. Performance with Rail-to-Rail Input Signals

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700 **www.analog.com**
Fax: 781.326.8703

AK4683

Asynchronous Multi-Channel Audio CODEC with DIR/T

GENERAL DESCRIPTION

The AK4683 is a single chip CODEC that includes two channels of ADC and four channels of DAC. The ADC outputs 24bit data and the DAC accepts up to 24bit input data. The ADC has the Enhanced Dual Bit architecture with wide dynamic range. The DAC introduces the new developed Advanced Multi-Bit architecture, and achieves wider dynamic range and lower outband noise. The also has digital audio receiver (DIR) and transmitter (DIT) compatible with 192kHz, 24bits. The DIR can automatically detect a Non-PCM bit stream such as Dolby Digital (AC-3)*.

The AK4683 has a dynamic range of 100dB for ADC, 106dB for DAC and is well suited for digital TV and home theater system.

* Dolby Digital (AC-3) is a trademark of Dolby Laboratories.

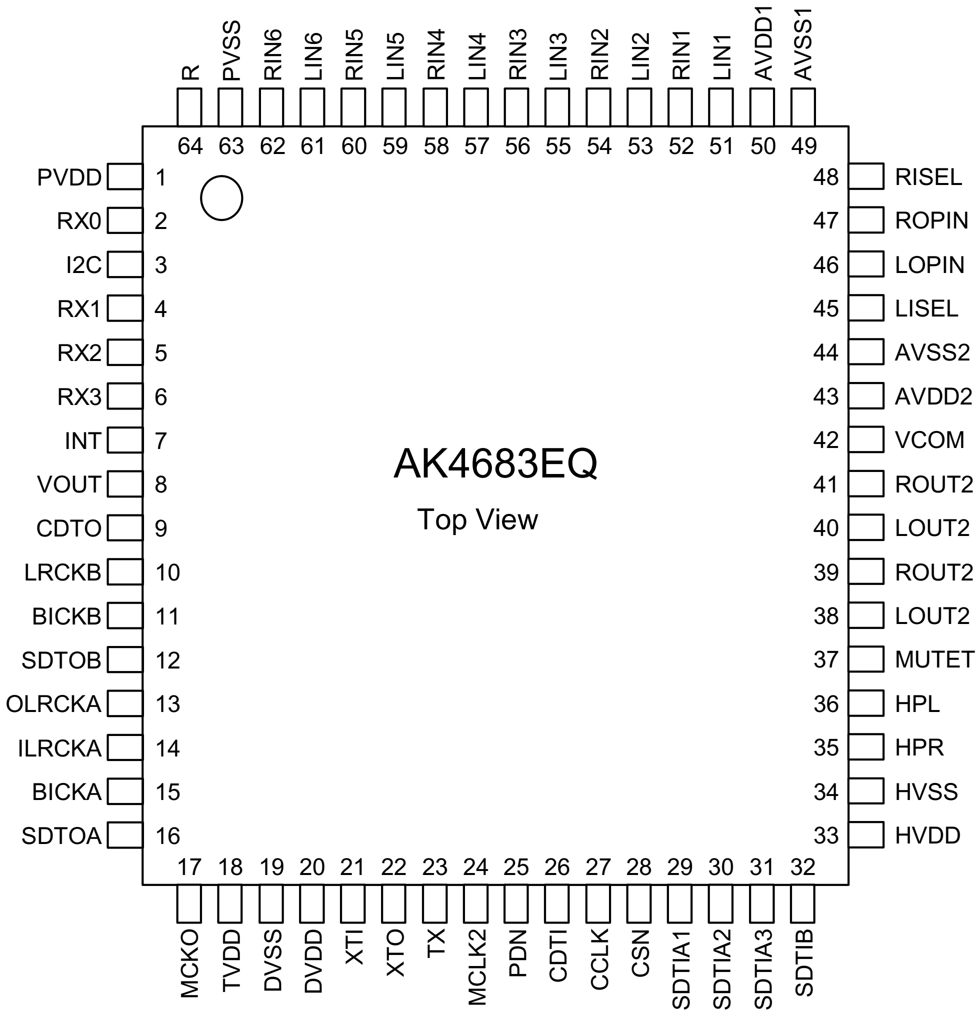
FEATURES

- ☐ **ADC/DAC part**
  - ☐ **Asynchronous ADC/DAC Operation**
  - ☐ **6:1 Input Selector with Pre-amp**
  - ☐ **2ch 24bit ADC**
    - **64x Oversampling**
    - **Sampling Rate up to 96kHz**
    - **Linear Phase Digital Anti-Alias Filter**
    - **Single-Ended Input**
    - **S/(N+D): 90dB**
    - **Dynamic Range, S/N: 100dB**
    - **Digital HPF for Offset Cancellation**
    - **Channel Independent Digital Volume (+24/-103dB, 0.5dB/step)**
    - **Soft Mute**
    - **Overflow Flag**
  - ☐ **4ch 24bit DAC**
    - **128x Oversampling**
    - **Sampling Rate up to 192kHz**
    - **24bit 8 times Digital Filter**
    - **Single-Ended Outputs**
    - **S/(N+D): 90dB**
    - **Dynamic Range, S/N: 106dB**
    - **Channel Independent Digital Volume (+12/-115dB, 0.5dB/step)**
    - **Soft Mute**
    - **De-emphasis Filter (32kHz, 44.1kHz, 48kHz)**
    - **Zero Detect Function**
  - ☐ **Stereo Headphone Amp with Volume**
    - **50mW at 16ohm**
    - **Click-noise free at Power on/off**
  - ☐ **High Jitter Tolerance**

■ Ordering Guide

AK4683EQ -20 ~ +85°C 64pin LQFP (0.5mm pitch)
AKD4683 Evaluation Board for AK4683

■ Pin Layout



■ Compatibility with AK4588

Functions	AK4588	AK4683
DAC, ADC Asynchronous operation	NOT Available	Available
DAC ch#	8ch	4ch
HP-Amp	-	2ch
ADC Input selector	-	6:1

PIN/FUNCTION

No.	Pin Name	I/O	Function
1	PVDD	-	PLL Power supply Pin, 4.5V~5.5V
2	RX0	I	Receiver Channel 0 Pin (Internal biased pin. Internally biased at PVDD/2)
3	I2C	I	Control Mode Select Pin. "L": 4-wire Serial, "H": I^2C Bus
4	RX1	I	Receiver Channel 1 Pin
5	RX2	I	Receiver Channel 2 Pin
6	RX3	I	Receiver Channel 3 Pin
7	INT	O	Interrupt Pin
8	VOUT	O	V-bit Output Pin for Receiver Input
	DZF	O	Zero Input Detect Pin When the input data of DAC follow total 8192 LRCK cycles with "0" input data, this pin goes to "H". And when RSTN1 bit is "0", PWDA bit is "0", this pin goes to "H".
	OVF	O	Analog Input Overflow Detect Pin This pin goes to "H" if the analog input of Lch or Rch overflows.
9	CDTO	O	Control Data Output Pin in Serial Mode and I2C pin = "L".
10	LRCKB	I/O	Channel Clock B Pin
11	BICKB	I/O	Audio Serial Data Clock B Pin
12	SDTOB	O	Audio Serial Data Output B Pin
13	OLRCKA	I/O	Output Channel Clock A Pin
14	ILRCKA	I/O	Input Channel Clock A Pin
15	BICKA	I/O	Audio Serial Data Clock A Pin
16	SDTOA	O	Audio Serial Data Output A Pin
17	MCKO	O	Master Clock Output Pin
18	TVDD	-	Output Buffer Power Supply Pin, 2.7V~5.5V
19	DVSS	-	Digital Ground Pin, 0V
20	DVDD	-	Digital Power Supply Pin, 4.5V~5.5V
21	XTI	I	X'tal Input Pin
22	XTO	O	X'tal Output Pin
23	TX	O	Transmit Channel Output pin When DIT bit = "0", RX0~3 Through. When DIT bit = "1", Internal DIT Output.
24	MCLK2	I	Master Clock Input Pin
25	PDN	I	Power-Down Mode & Reset Pin When "L", the AK4683 is powered-down, all registers are reset. And then all digital output pins go "L". The AK4683 must be reset once upon power-up.
26	CDTI	I	Control Data Input Pin in Serial Mode and I2C pin = "L".
	SDA	I/O	Control Data Pin in Serial Mode and I2C pin = "H".
27	CCLK	I	Control Data Clock Pin in Serial Mode and I2C pin = "L"
	SCL	I	Control Data Clock Pin in Serial Mode and I2C pin = "H"
28	CSN	I	Chip Select Pin in Serial Mode and I2C pin = "L".
	TEST	I	This pin should be connected to DVSS in Serial Mode and I2C pin = "H".
29	SDTIA1	I	Audio Serial Data Input A1 Pin
30	SDTIA2	I	Audio Serial Data Input A2 Pin
31	SDTIA3	I	Audio Serial Data Input A3 Pin
32	SDTIB	I	Audio Serial Data Input B Pin
33	HVDD	-	HP Power Supply Pin, 4.5V~5.5V
34	HVSS	-	HP Ground Pin, 0V
35	HPR	O	HP Rch Output Pin
36	HPL	O	HP Lch Output Pin
37	MUTET	-	HP Common Voltage Output Pin 1μF capacitor should be connected to HVSS externally.

No.	Pin Name	I/O	Function
38	LOUT2	O	DAC2 Lch Positive Analog Output Pin
39	ROUT2	O	DAC2 Rch Positive Analog Output Pin
40	LOUT1	O	DAC1 Lch Positive Analog Output Pin
41	ROUT1	O	DAC1 Rch Positive Analog Output Pin
42	VCOM	-	DAC/ADC Common Voltage Output Pin 2.2μF capacitor should be connected to AVSS2 externally.
43	AVDD2	-	DAC Power Supply Pin, 4.5V~5.5V
44	AVSS2	-	DAC Ground Pin, 0V
45	LISEL	O	Lch Feedback Resistor Output Pin
46	LOPIN	O	Lch Feedback Resistor Input Pin. 0.5 x AVDD1.
47	ROPIN	O	Rch Feedback Resistor Input Pin. 0.5 x AVDD1.
48	RISEL	O	Rch Feedback Resistor Output Pin
49	AVSS1	-	ADC Ground Pin, 0V
50	AVDD1	-	ADC Power Supply Pin, 4.5V~5.5V
51	LIN1	I	Lch Input 1 Pin
52	RIN1	I	Rch Input 1 Pin
53	LIN2	I	Lch Input 2 Pin
54	RIN2	I	Rch Input 2 Pin
55	LIN3	I	Lch Input 3 Pin
56	RIN3	I	Rch Input 3 Pin
57	LIN4	I	Lch Input 4 Pin
58	RIN4	I	Rch Input 4 Pin
59	LIN5	I	Lch Input 5 Pin
60	RIN5	I	Rch Input 5 Pin
61	LIN6	I	Lch Input 6 Pin
62	RIN6	I	Rch Input 6 Pin
63	PVSS	-	PLL Ground pin
64	R	-	External Resistor Pin 12kΩ +/-1% resistor should be connected to PVSS externally.

Note: All input pins except internal biased pin (RX0) and analog input pins (LIN1-6, RIN1-6) should not be left floating.

■ Handling of Unused Pin

The unused I/O pins should be processed appropriately as below.

Classification	Pin Name	Setting
Analog	RX0, LOUT1-2, ROUT1-2, LIN1-6, RIN1-6	These pins should be open.
Digital	INT, XTO, MCKO, VOUT/DZF/OVF, SDTOA-B, CDTO, TX	These pins should be open.
	RX1-3, CSN, CCLK, CDTI, XTI, MCLK2, OLRCKA, ILRCKA, BICKA, SDTIA1-3, LRCKB, BICKB, SDTIB	These pins should be connected to DVSS.

CS5361

114 dB, 192 kHz, Multi-Bit Audio A/D Converter

Features

- Advanced Multi-bit Delta-sigma Architecture
- 24-bit Conversion
- 114 dB Dynamic Range
- -105 dB THD+N
- System Sampling Rates up to 192 kHz
- 135 mW Power Consumption
- High-pass Filter and DC Offset Calibration
- Supports Logic Levels Between 5 and 2.5 V
- Differential Analog Architecture
- Overflow Detection
- Pin-compatible with the CS5381

General Description

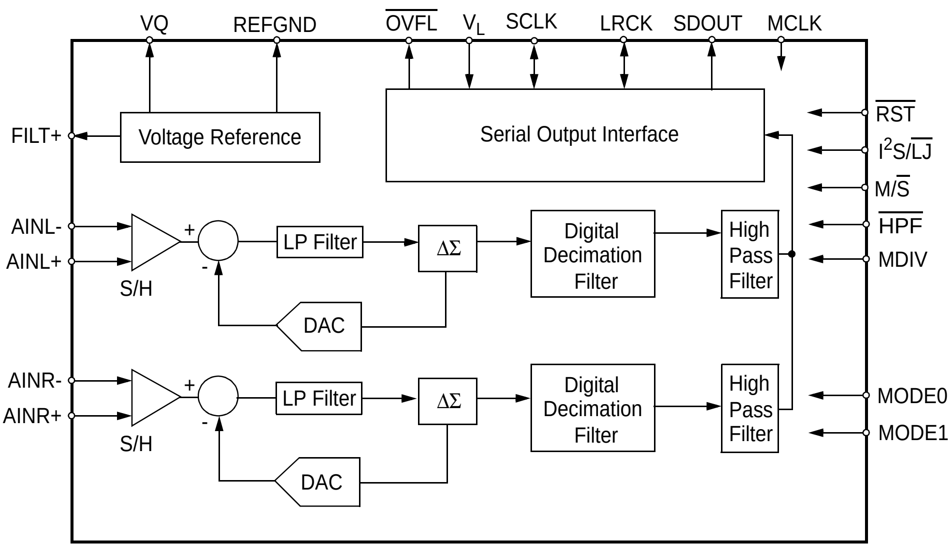
The CS5361 is a complete analog-to-digital converter for digital audio systems. It performs sampling, analog-to-digital conversion, and anti-alias filtering. The CS5361 generates 24-bit values for both left and right inputs in serial form at sample rates up to 192 kHz per channel.

The CS5361 uses a 5th-order, multi-bit, delta-sigma modulator followed by digital filtering and decimation. This removes the need for an external anti-alias filter. The ADC uses a differential architecture which provides excellent noise rejection.

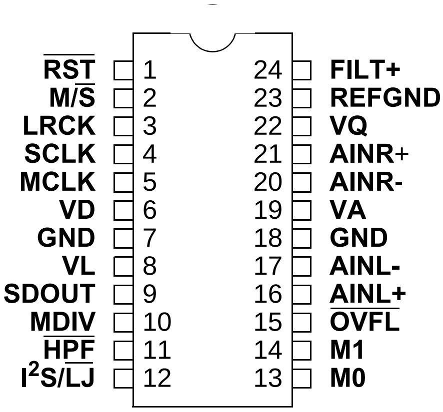
The CS5361 is ideal for audio systems requiring wide dynamic range, negligible distortion, and low noise. These applications include A/V receivers, DVD-R, CD-R, digital mixing consoles, and effects processors.

ORDERING INFORMATION

CS5361-KSZ	-10° to 70°C	24-pin SOIC	Lead Free
CS5361-KZZ	-10° to 70°C	24-pin TSSOP	Lead Free
CS5361-DZZ	-40° to 85°C	24-pin TSSOP	Lead Free
CDB5361	Evaluation Board		



2.0 PIN DESCRIPTIONS



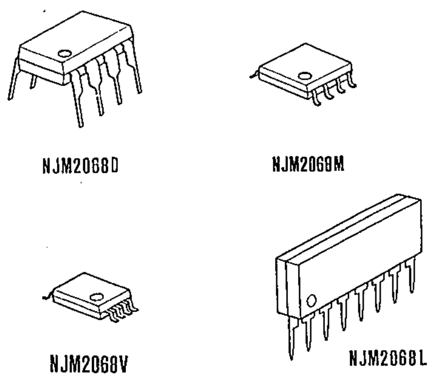
Pin Name	#	Pin Description
RST	1	**Reset** (*Input*) - The device enters a low power mode when low.
M/S	2	**Master/Slave Mode** *(Input)* - Selects operation as either clock master or slave.
LRCK	3	**Left Right Clock** (*Input*/*Output*) - Determines which channel, Left or Right, is currently active on the serial audio data line.
SCLK	4	**Serial Clock** (*Input*/*Output*) - Serial clock for the serial audio interface.
MCLK	5	**Master Clock** (*Input*) - Clock source for the delta-sigma modulator and digital filters.
VD	6	**Digital Power** (*Input*) **-** Positive power supply for the digital section.
GND	7,18	**Ground** (*Input*) - Ground reference. Must be connected to analog ground.
VL	8	**Logic Power** (*Input*) **-** Positive power for the digital input/output.
SDOUT	9	**Serial Audio Data Output** (*Output*) - Output for two's complement serial audio data.
MDIV	10	**MCLK Divider** *(Input)* **-** Enables a master clock divide by two function.
HPF	11	**High-pass Filter Enable** *(Input)* **-** Enables the Digital High-Pass Filter.
I²S/LJ	12	**Serial Audio Interface Format Select** (*Input*) -Selects either the left-justified or I²S format for the SAI.
M0 **M1**	13, 14	**Mode Selection** (*Input*) - Determines the operational mode of the device.
OVFL	15	**Overflow** *(Output, open drain)* **-** Detects an overflow condition on both left and right channels.
AINL+ **AINL-**	16, 17	**Differential Left Channel Analog Input** (*Input*) - Signals are presented differentially to the delta-sigma modulators via the AINL+/- pins.
VA	19	**Analog Power** (*Input*) **-** Positive power supply for the analog section.
AINR- **AINR+**	20, 21	**Differential Right Channel Analog Input** (*Input*) -Signals are presented differentially to the delta-sigma modulators via the AINR+/- pins.
VQ	22	**Quiescent Voltage** *(Output)* **-** Filter connection for the internal quiescent reference voltage.
REF_GND	23	**Reference Ground** (*Input*) - Ground reference for the internal sampling circuits.
FILT+	24	**Positive Voltage Reference** (*Output*) **-** Positive reference voltage for the internal sampling circuits.

LOW-NOISE DUAL OPERATIONAL AMPLIFIER

■ GENERAL DESCRIPTION

The NJM2068 is a high performance, low noise dual operational amplifier. This amplifier features popular pin-out, superior noise performance, and superior total harmonic distortion. This amplifier also features guaranteed noise performance with substantially higher gain-bandwidth product and slew rate which far exceeds that of the 4558 type amplifier. The specially designed low noise input transistors allow the NJM2068 to be used in very low noise signal processing applications such as audio preamplifiers and servo error amplifier.

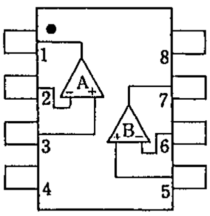
■ PACKAGE OUTLINE



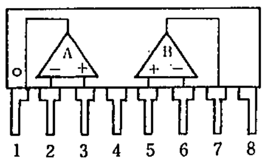
■ FEATURES

- Operating Voltage (±4V ~ ±18V)
- Low Total Harmonic Distortion (0.001% typ.)
- Low Noise Voltage (FLAT+JISA, 0.56 μV typ.)
- High Slew Rate (6V/μs typ.)
- Unity Gain Bandwidth (27MHz @f=10kHz)
- Package Outline DIP8, DMP8, SIP8, SSOP8
- Bipolar Technology

■ PIN CONFIGURATION



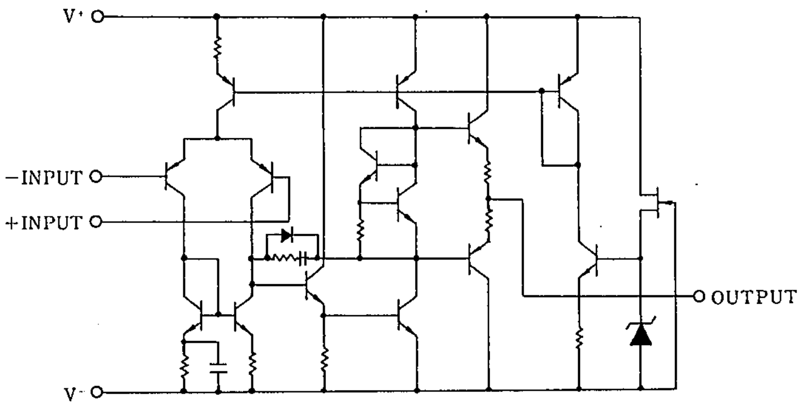
NJM2068D
NJM2068M
NJM2068V



NJM2068L

PIN FUNCITON
1. A OUTPUT
2. A−INPUT
3. A+INPUT
4. V⁻
5. B+INPUT
6. B−INPUT
7. B OUTPUT
8. V⁺

■ EQUIVALENT CIRCUIT (1/2 Shown)



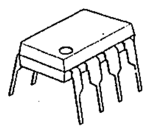
HIGH PERFORMANCE LOW-NOISE DUAL OPERATIONAL AMPLIFIER

■ GENERAL DESCRIPTION

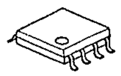
The NJM5532 is a high performance dual low noise operational amplifier. Compared to the standard dual operational amplifiers, such as the NJM1458, it shows better noise performance, improved output drive capability, and considerably higher small-signal and power bandwidths.

This makes the device especially suitable for application in high quality and professional audio equipment, instrumentation, control circuits, and telephone channel amplifiers. The op amp is internally compensated for gains equil to one If very low noise is of prime importance, version be used which has guaranteed NJM5532DD it is recommended that the noise specifications.

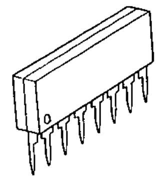
■ PACKAGE OUTLINE



NJM5532D



NJM5532M

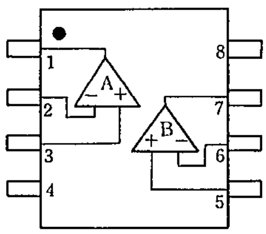


NJM5532L

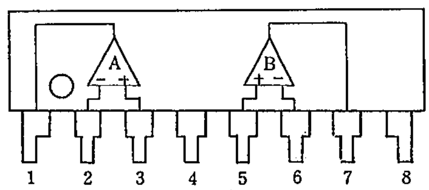
■ FEATURES

- Operating Voltage (±3V～±20V)
- Small Signal Bandwidth (10MHz typ.)
- Output Drive Capability (600Ω, 10Vrms typ.)
- Input Noise Voltage (5nV/$\sqrt{Hz}$ typ.)
- Power Bandwidth (140kHz typ.)
- Slew Rate (8V/μs typ.)
- Package Outline DIP8, DMP8, SIP8
- Bipolar Technology

■ PIN CONFIGURATION



NJM5532D
NJM5532M

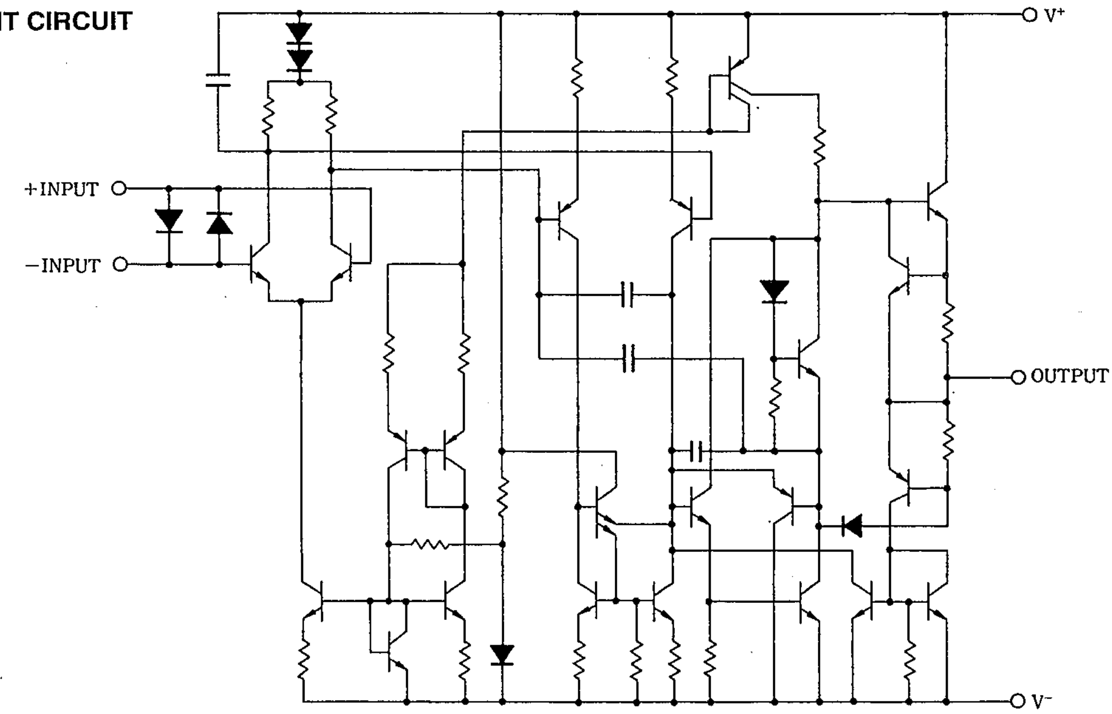


NJM5532L

PIN FUNCTION
1. A OUTPUT
2. A−INPUT
3. A+INPUT
4. V⁻
5. B+INPUT
6. B−INPUT
7. B OUTPUT
8. V⁺

■ EQUIVALENT CIRCUIT

(1/2 Shown)



ANALOG FUNCTION SWITCH

■ GENERAL DESCRIPTION

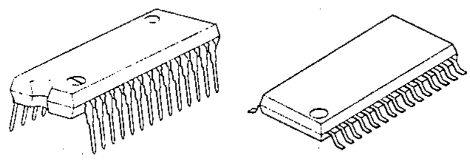
The NJU7313A is a dual 4-channel and quad 2-channel analog function switch, especially suitable for input selector of audio equipments.

The high break down voltage analog switch controlled by 14-bit serial data based on logic operating voltage (5V) can ON and OFF of ±15V signal.

The analog switch is realized superior linearity of on-resistance in all voltage range, low distortion and wide dynamic range.

Furthermore, the both of single and dual power supply application provides easy designing.

■ PACKAGE OUTLINE

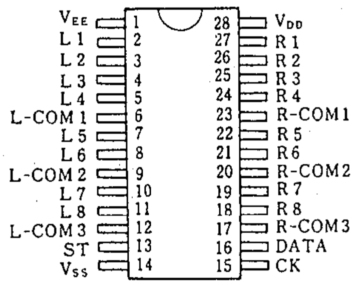


NJU7313AL NJU7313AM

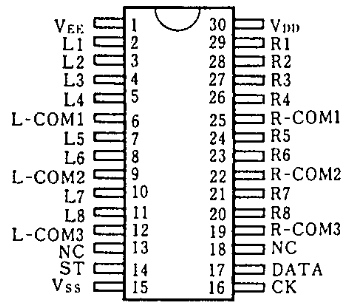
■ FEATURES

- Analog switch: dual 3 channel and quad 2 channel.
- High Break Down Voltage ------ ±15V.
- Low Distortion ------ THD: 0.002% (typ).
- Superior Linearity of ON Resistance.
- Serial Data Control.
- Package Outline SDIP 28 / DMP 30
- C-MOS Technology

■ PIN CONFIGURATION

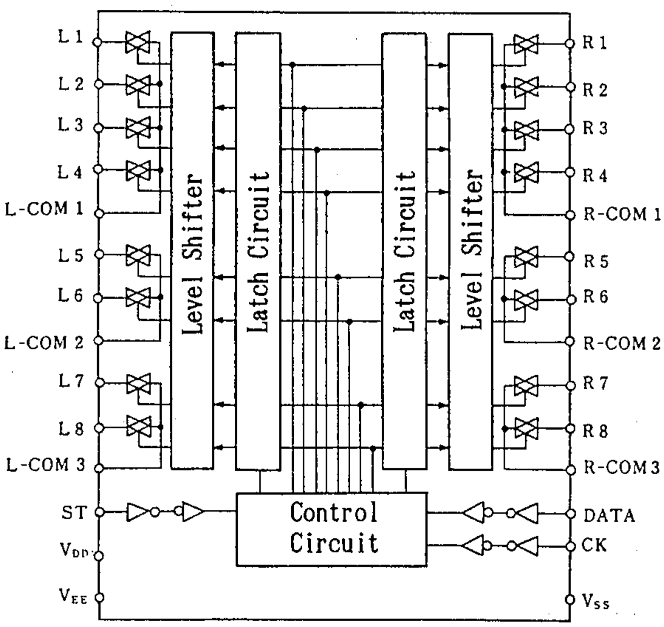


NJU7313AL



NJU7313AM

■ BLOCK DIAGRAM



ANALOG DEVICES

Dual Bipolar/JFET, Audio Operational Amplifier

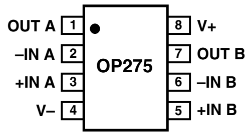
OP275*

FEATURES
Excellent Sonic Characteristics
Low Noise: 6 nV/√Hz
Low Distortion: 0.0006%
High Slew Rate: 22 V/µs
Wide Bandwidth: 9 MHz
Low Supply Current: 5 mA
Low Offset Voltage: 1 mV
Low Offset Current: 2 nA
Unity Gain Stable
SOIC-8 Package
PDIP-8 Package

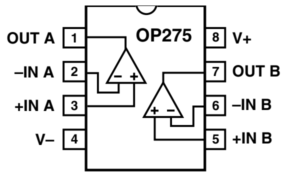
APPLICATIONS
High Performance Audio
Active Filters
Fast Amplifiers
Integrators

PIN CONNECTIONS

8-Lead Narrow-Body SOIC (S Suffix)



8-Lead PDIP (P Suffix)



GENERAL DESCRIPTION

The OP275 is the first amplifier to feature the Butler Amplifier front end. This new front end design combines both bipolar and JFET transistors to attain amplifiers with the accuracy and low noise performance of bipolar transistors, and the speed and sound quality of JFETs. Total Harmonic Distortion plus Noise equals that of previous audio amplifiers, but at much lower supply currents.

A very low l/f corner of below 6 Hz maintains a flat noise density response. Whether noise is measured at either 30 Hz or 1 kHz, it is only 6 nV√Hz. The JFET portion of the input stage gives the OP275 its high slew rates to keep distortion low, even when large output swings are required, and the 22 V/µs slew rate of the OP275 is the fastest of any standard audio amplifier. Best of all, this low noise and high speed are accomplished using less than 5 mA of supply current, lower than any standard audio amplifier.

Improved dc performance is also provided with bias and offset currents greatly reduced over purely bipolar designs. Input offset voltage is guaranteed at 1 mV and is typically less than 200 µV. This allows the OP275 to be used in many dc-coupled or summing applications without the need for special selections or the added noise of additional offset adjustment circuitry.

The output is capable of driving 600 Ω loads to 10 V rms while maintaining low distortion. THD + Noise at 3 V rms is a low 0.0006%.

The OP275 is specified over the extended industrial (–40°C to +85°C) temperature range. OP275s are available in both plastic DIP and SOIC-8 packages. SOIC-8 packages are available in 2500-piece reels. Many audio amplifiers are not offered in SOIC-8 surface-mount packages for a variety of reasons; however, the OP275 was designed so that it would offer full performance in surface-mount packaging.

*Protected by U.S. Patent No. 5,101,126.

REV. C

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781/329-4700 www.analog.com
Fax: 781/326-8703

16-bit I^{2}C and SMBus I/O port with interrupt — PCA9555

FEATURES

- Operating power supply voltage range of 2.3 V to 5.5 V
- 5 V tolerant I/Os
- Polarity inversion register
- Active-LOW interrupt output
- Low stand-by current
- Noise filter on SCL/SDA inputs
- No glitch on power-up
- Internal power-on reset
- 16 I/O pins which default to 16 inputs
- 0 kHz to 400 kHz clock frequency
- ESD protection exceeds 2000 V HBM per JESD22-A114, 200 V MM per JESD22-A115, and 1000 V CDM per JESD22-C101
- Latch-up testing is done to JESDEC Standard JESD78 which exceeds 100 mA
- Five packages offered: DIP24, SO24, SSOP24, TSSOP24, and HVQFN24

DESCRIPTION

The PCA9555 is a 24-pin CMOS device that provide 16 bits of General Purpose parallel Input/Output (GPIO) expansion for I^{2}C/SMBus applications and was developed to enhance the Philips family of I^{2}C I/O expanders. The improvements include higher drive capability, 5 V I/O tolerance, lower supply current, individual I/O configuration, and smaller packaging. I/O expanders provide a simple solution when additional I/O is needed for ACPI power switches, sensors, pushbuttons, LEDs, fans, etc.

The PCA9555 consist of two 8-bit Configuration (Input or Output selection); Input, Output and Polarity inversion (Active-HIGH or Active-LOW operation) registers. The system master can enable the I/Os as either inputs or outputs by writing to the I/O configuration bits. The data for each Input or Output is kept in the corresponding Input or Output register. The polarity of the read register can be inverted with the Polarity Inversion Register. All registers can be read by the system master. Although pin-to-pin and I^{2}C address compatible with the PCF8575, software changes are required due to the enhancements and are discussed in *Application Note AN469*.

The PCA9555 open-drain interrupt output is activated when any input state differs from its corresponding input port register state and is used to indicate to the system master that an input state has changed. The power-on reset sets the registers to their default values and initializes the device state machine.

Three hardware pins (A0, A1, A2) vary the fixed I^{2}C address and allow up to eight devices to share the same I^{2}C/SMBus. The fixed I^{2}C address of the PCA9555 is the same as the PCA9554 allowing up to eight of these devices in any combination to share the same I^{2}C/SMBus.

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	ORDER CODE	TOPSIDE MARK	DRAWING NUMBER
24-Pin Plastic DIP	–40 °C to +85 °C	PCA9555N	PCA9555	SOT101-1
24-Pin Plastic SO	–40 °C to +85 °C	PCA9555D	PCA9555D	SOT137-1
24-Pin Plastic SSOP	–40 °C to +85 °C	PCA9555DB	PCA9555	SOT340-1
24-Pin Plastic TSSOP	–40 °C to +85 °C	PCA9555PW	PCA9555	SOT355-1
24-Pin Plastic HVQFN	–40 °C to +85 °C	PCA9555BS	9555	SOT616-1

Standard packing quantities and other packaging data are available at www.standardproducts.philips.com/packaging.
I^{2}C is a trademark of Philips Semiconductors Corporation.
SMBus as specified by the Smart Battery System Implementers Forum is a derivative of the Philips I^{2}C patent.

PIN CONFIGURATION — DIP, SO, SSOP, TSSOP

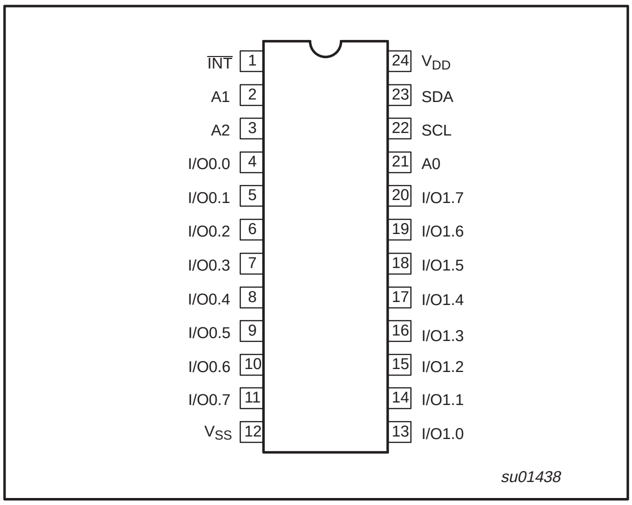


Figure 1. Pin configuration — DIP, SO, SSOP, TSSOP

PIN CONFIGURATION — HVQFN

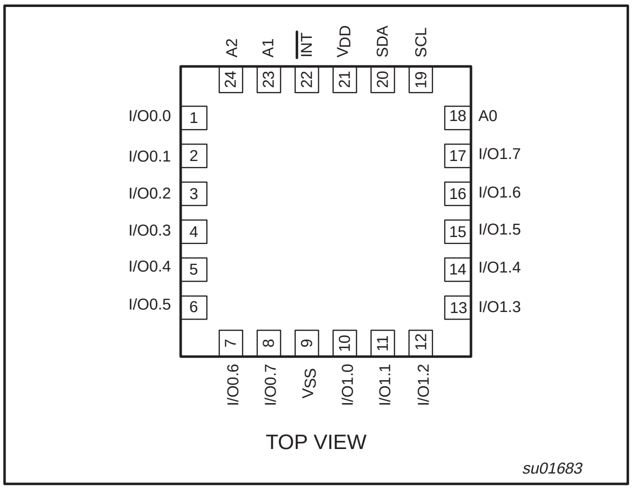


Figure 2. Pin configuration — HVQFN

PIN DESCRIPTION

PIN NUMBER		SYMBOL	FUNCTION
DIP, SO, SSOP, TSSOP	HVQFN		
1	22	$\overline{INT}$	Interrupt output (open-drain)
2	23	A1	Address input 1
3	24	A2	Address input 2
4–11	1–8	I/O0.0–I/O0.7	I/O0.0 to I/O0.7
12	9	V_{SS}	Supply ground
13–20	10–17	I/O1.0–I/O1.7	I/O1.0 to I/O1.7
21	18	A0	Address input 0
22	19	SCL	Serial clock line
23	20	SDA	Serial data line
24	21	V_{DD}	Supply voltage

BLOCK DIAGRAM

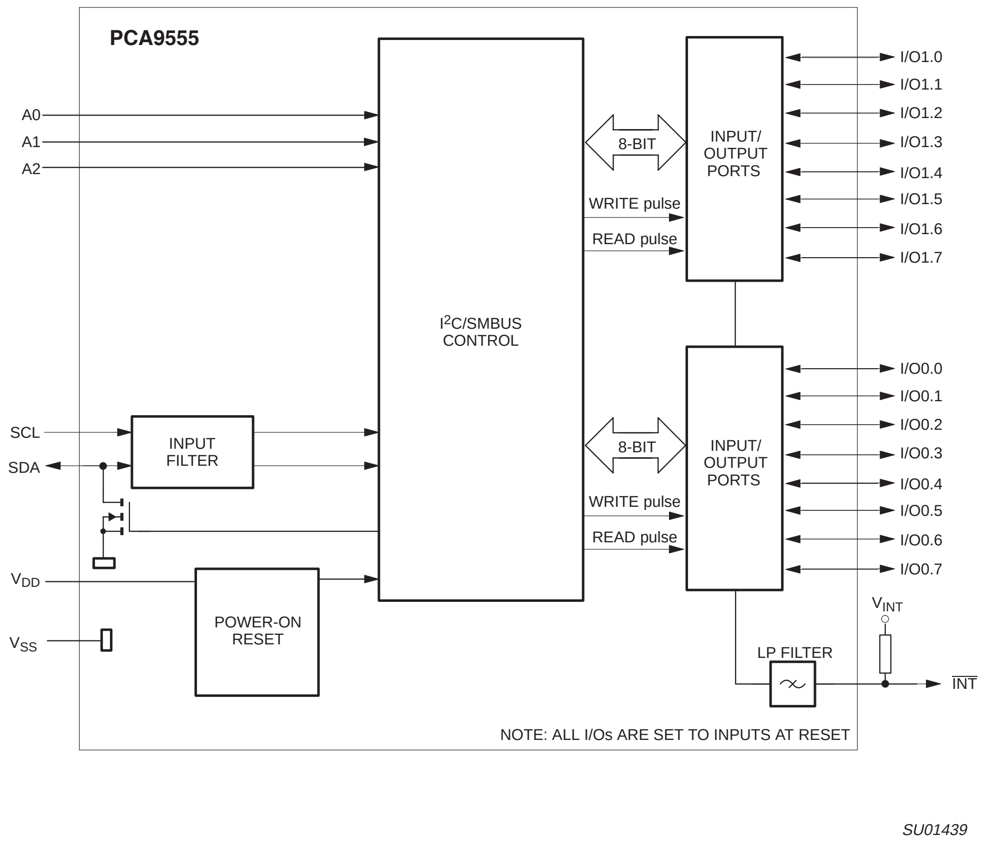


Figure 3. Block diagram

C-MOS QUAD SPST ANALOG SWITCH

■ GENERAL DESCRIPTION

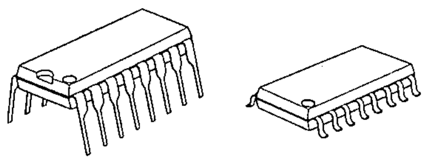
The NJU201A is a quad break-before-make SPST analog switch protected up to 44V operating voltage.

All switches are controlled by TTL or C-MOS compatible input.

The low on-state resistance is about half compare with the NJU7301.

The NJU201A is functionally and pin-to-pin compatible with SILICONIX DG201A.

■ PACKAGE OUTLINE

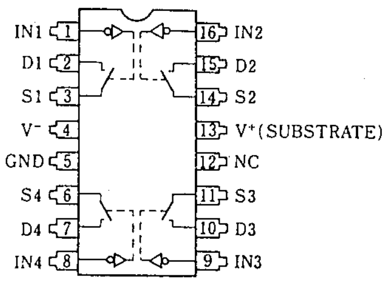


NJU201AD NJU201AM

■ FEATURES

- High Break Down Voltage -- 44V
- Low On-state Resistance
- Package Outline -- DIP/DMP 16
- C-MOS Technology

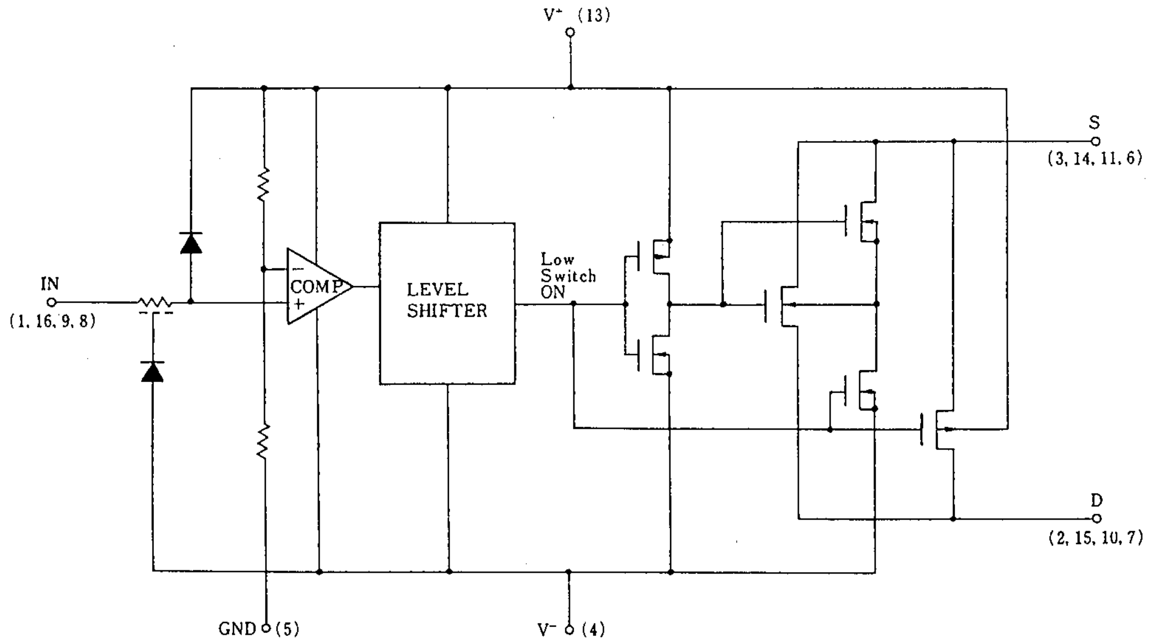
■ PIN CONFIGURATION



■ TRUTH TABLE

Logic (In)	Switch
0	ON
1	OFF

■ EQUIVALENT CIRCUIT



* Logic input threshold voltage V_{TH} is about $V^+ \times 0.128$(V).
When the designing, enough margin is required.

6

TL071, TL071A, TL071B, TL072
TL072A, TL072B, TL074, TL074A, TL074B
LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS080D – SEPTEMBER 1978 – REVISED AUGUST 1996

- **Low Power Consumption**
- **Wide Common-Mode and Differential Voltage Ranges**
- **Low Input Bias and Offset Currents**
- **Output Short-Circuit Protection**
- **Low Total Harmonic Distortion 0.003% Typ**
- **Low Noise V_n = 18 nV/$\sqrt{Hz}$ Typ at f = 1 kHz**
- **High Input Impedance . . . JFET Input Stage**
- **Internal Frequency Compensation**
- **Latch-Up-Free Operation**
- **High Slew Rate . . . 13 V/μs Typ**
- **Common-Mode Input Voltage Range Includes V_{CC+}**

description

The JFET-input operational amplifiers in the TL07_ series are designed as low-noise versions of the TL08_ series amplifiers with low input bias and offset currents and fast slew rate. The low harmonic distortion and low noise make the TL07_ series ideally suited for high-fidelity and audio preamplifier applications. Each amplifier features JFET inputs (for high input impedance) coupled with bipolar output stages integrated on a single monolithic chip.

The C-suffix devices are characterized for operation from 0°C to 70°C. The I-suffix devices are characterized for operation from −40°C to 85°C. The M-suffix devices are characterized for operation over the full military temperature range of −55°C to 125°C.

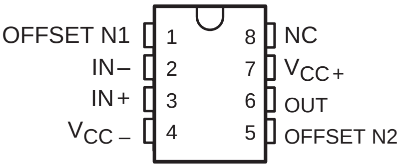
AVAILABLE OPTIONS

T_A	V_{IO}max AT 25°C	PACKAGE							
		SMALL OUTLINE (D)†	CHIP CARRIER (FK)	CERAMIC DIP (J)	CERAMIC DIP (JG)	PLASTIC DIP (N)	PLASTIC DIP (P)	TSSOP PACKAGE (PW)	FLAT PACKAGE (W)
0°C to 70°C	10 mV 6 mV 3 mV	TL071CD TL071ACD TL071BCD	—	—	—	—	TL071CP TL071ACP TL071BCP	TL071CPWLE — —	—
	10 mV 6 mV 3 mV	TL072CD TL072ACD TL072BCD	—	—	—	—	TL072CP TL072ACP TL072BCP	TL072CPWLE — —	—
	10 mV 6 mV 3 mV	TL074CD TL074ACD TL074BCD	—	—	—	TL074CN TL074ACN TL074BCN	—	TL074CPWLE — —	—
−40°C to 85°C	6 mV	TL071ID TL072ID TL074ID	—	—	—	— — TL074IN	TL071IP TL072IP —	—	—
−55°C to 125°C	6 mV 6 mV 9 mV	—	TL071MFK TL072MFK TL074MFK	— — TL074MJ	TL071MJG TL072MJG —	— — TL074MN	— TL072MP —	—	— — TL074MW

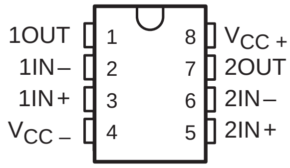
† The D package is available taped and reeled. Add the suffix R to the device type (e.g., TL071CDR). The PW package is only available left-ended taped and reeled (e.g., TL072CPWLE).

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

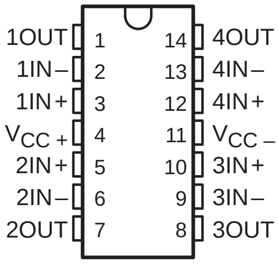
TL071, TL071A, TL071B
D, JG, P, OR PW PACKAGE
(TOP VIEW)



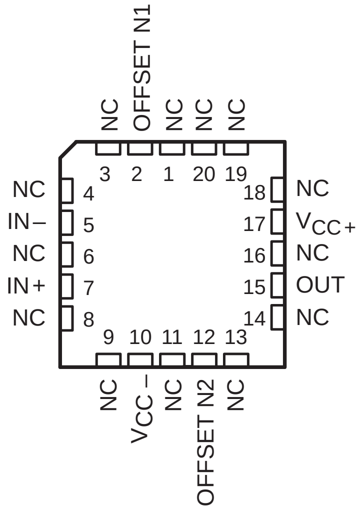
TL072, TL072A, TL072B
D, JG, P, OR PW PACKAGE
(TOP VIEW)



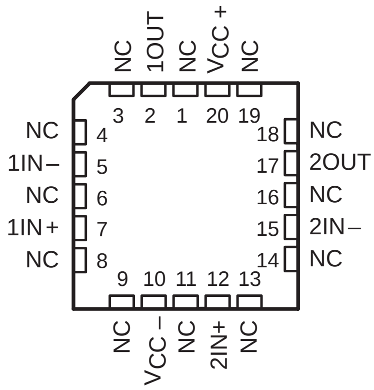
TL074, TL074A, TL074B
D, J, N, OR PW PACKAGE
TL074 . . . W PACKAGE
(TOP VIEW)



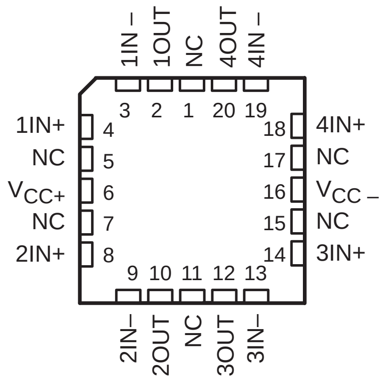
TL071
FK PACKAGE
(TOP VIEW)



TL072
FK PACKAGE
(TOP VIEW)



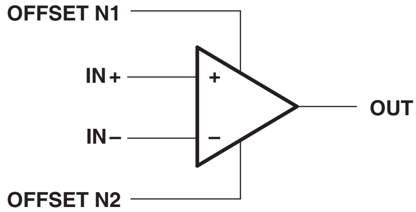
TL074
FK PACKAGE
(TOP VIEW)



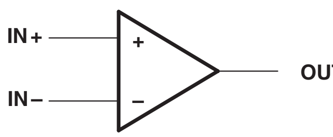
NC – No internal connection

symbols

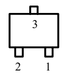
TL071



TL072 (each amplifier)
TL074 (each amplifier)

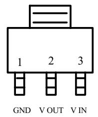


2SA1298 PNP
2SA1312 PNP
DTC343TK NPN
2SC3324 NPN
2SC3265 NPN
2SC1035 NPN

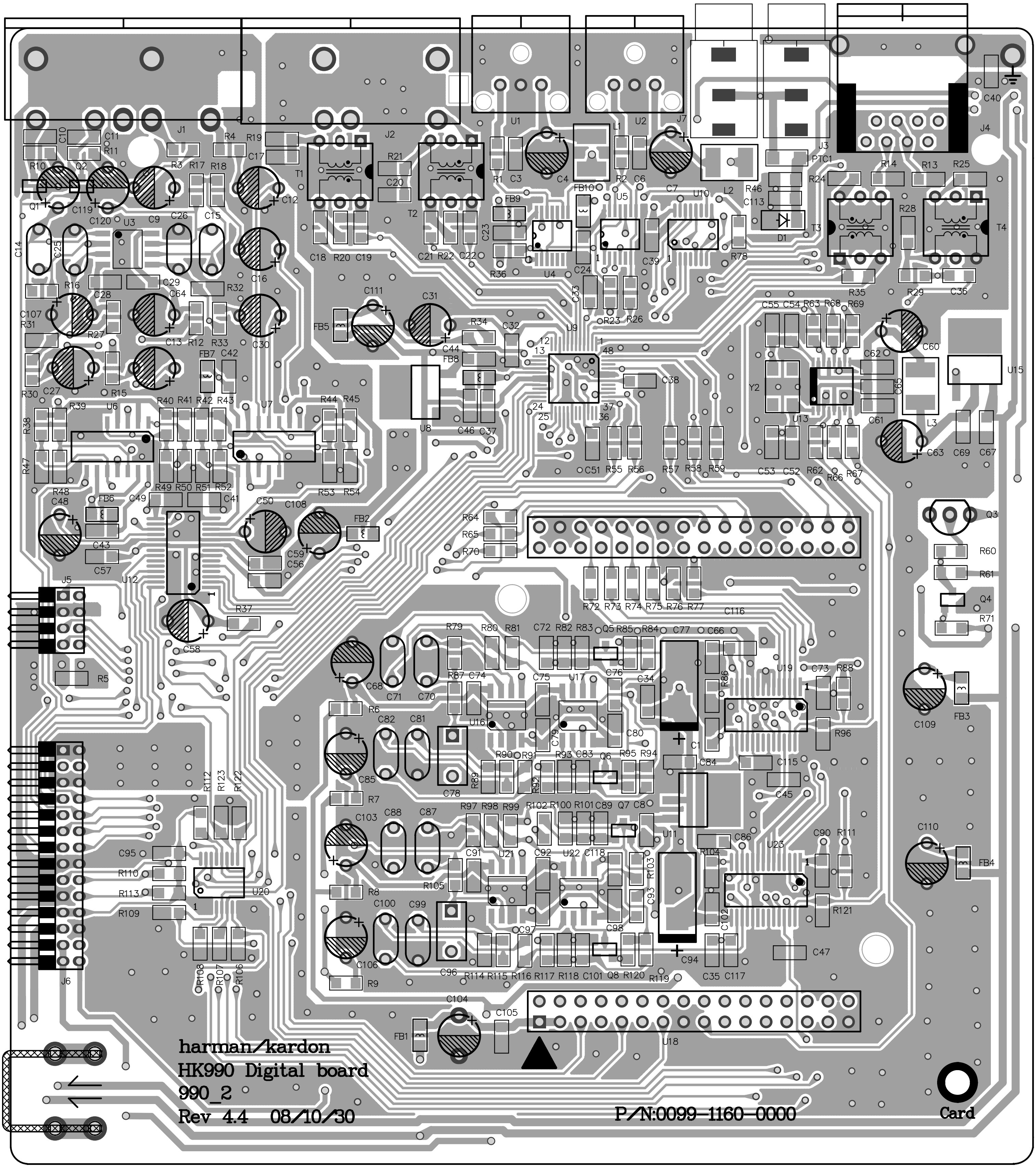


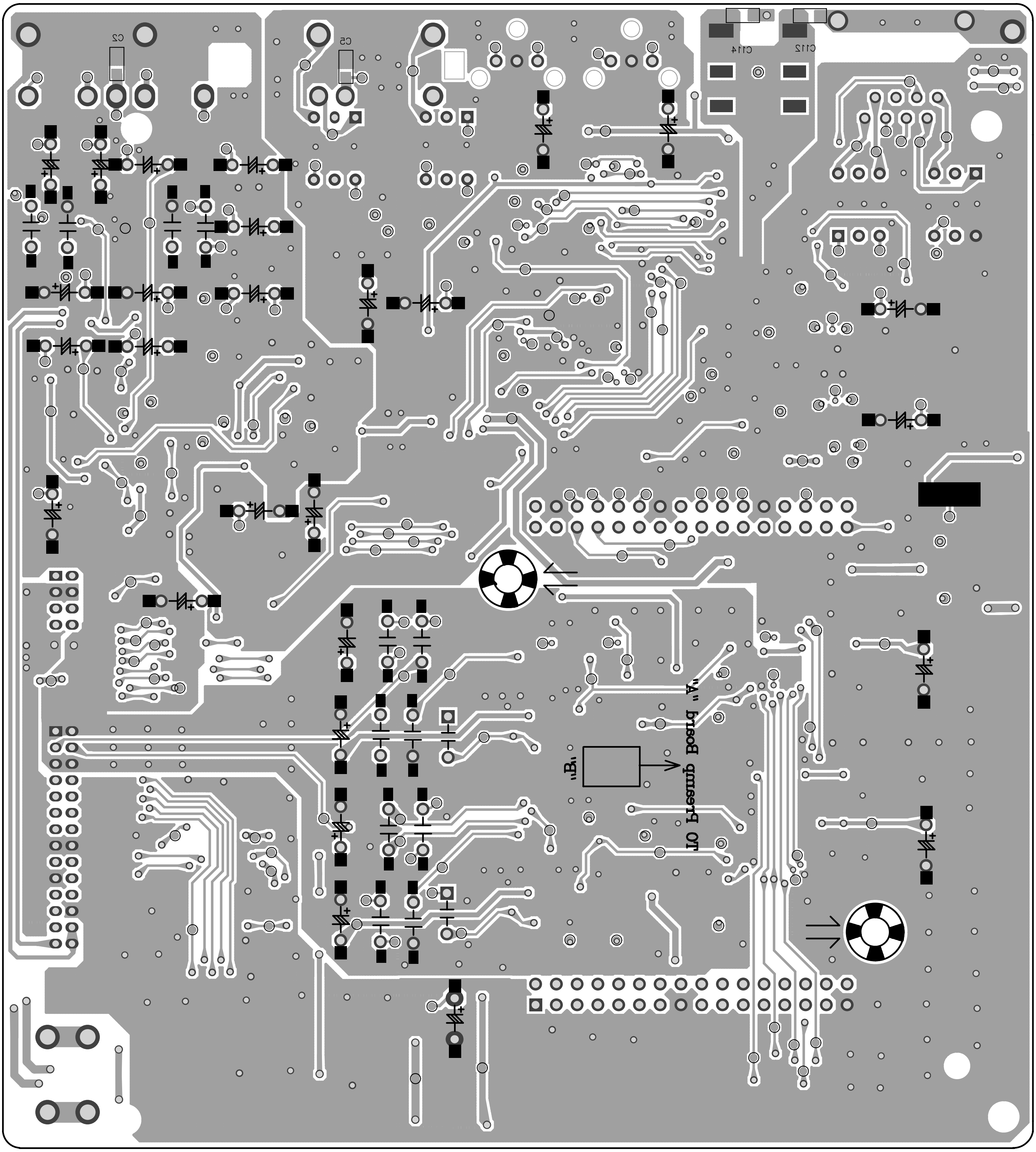
1) Emitter
2) Base
3) Collector

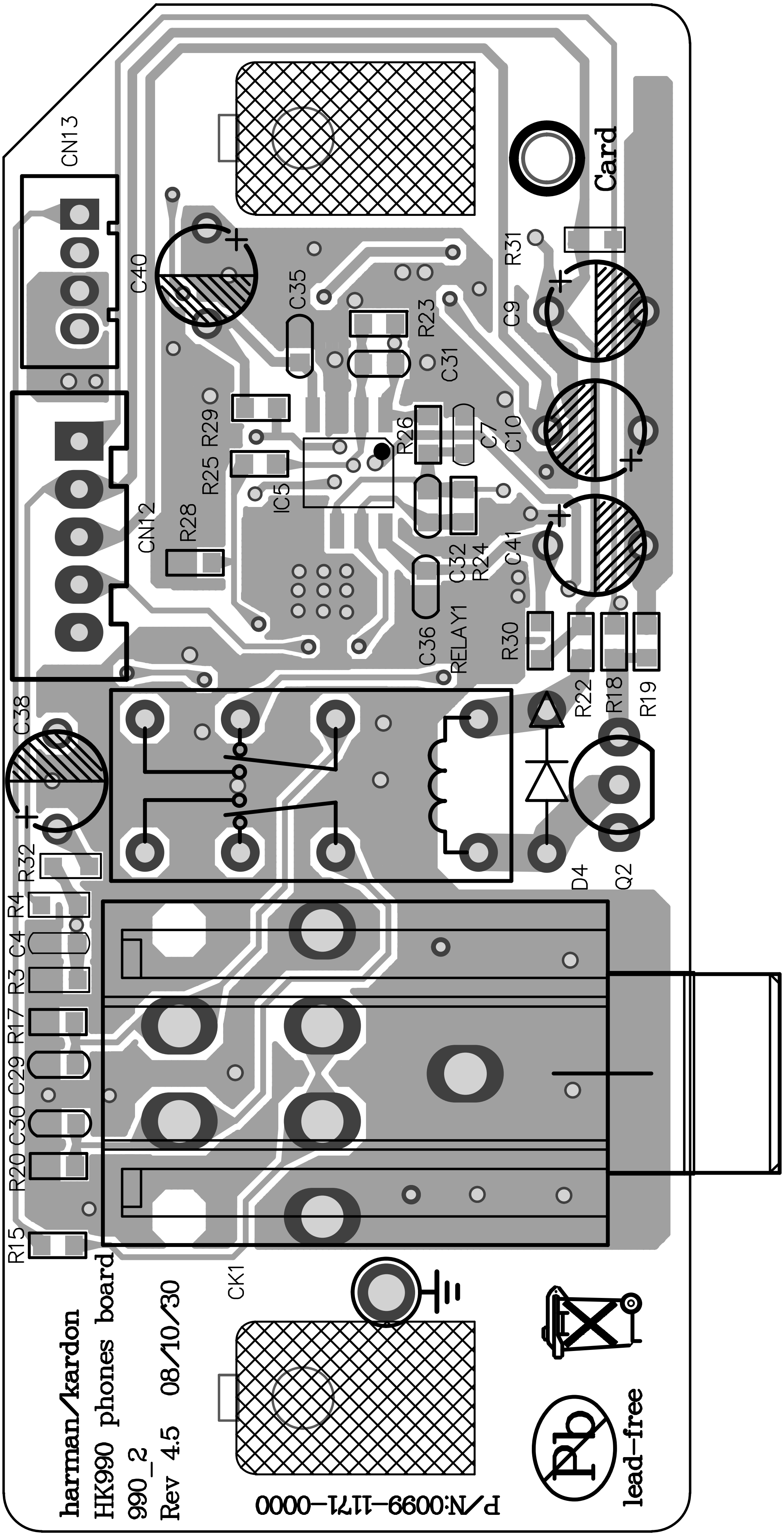
3-Pin Regulaeor IC
LD1117S5.0

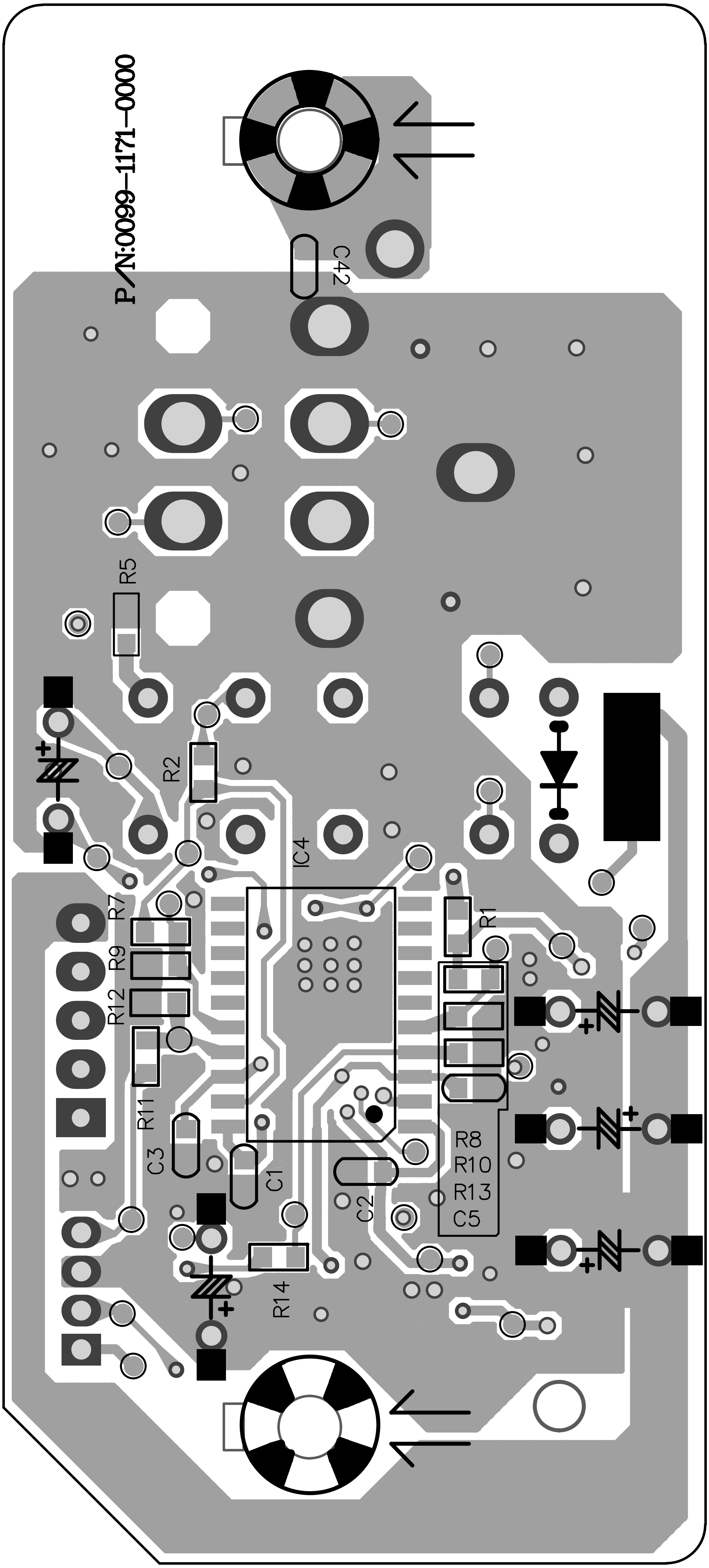


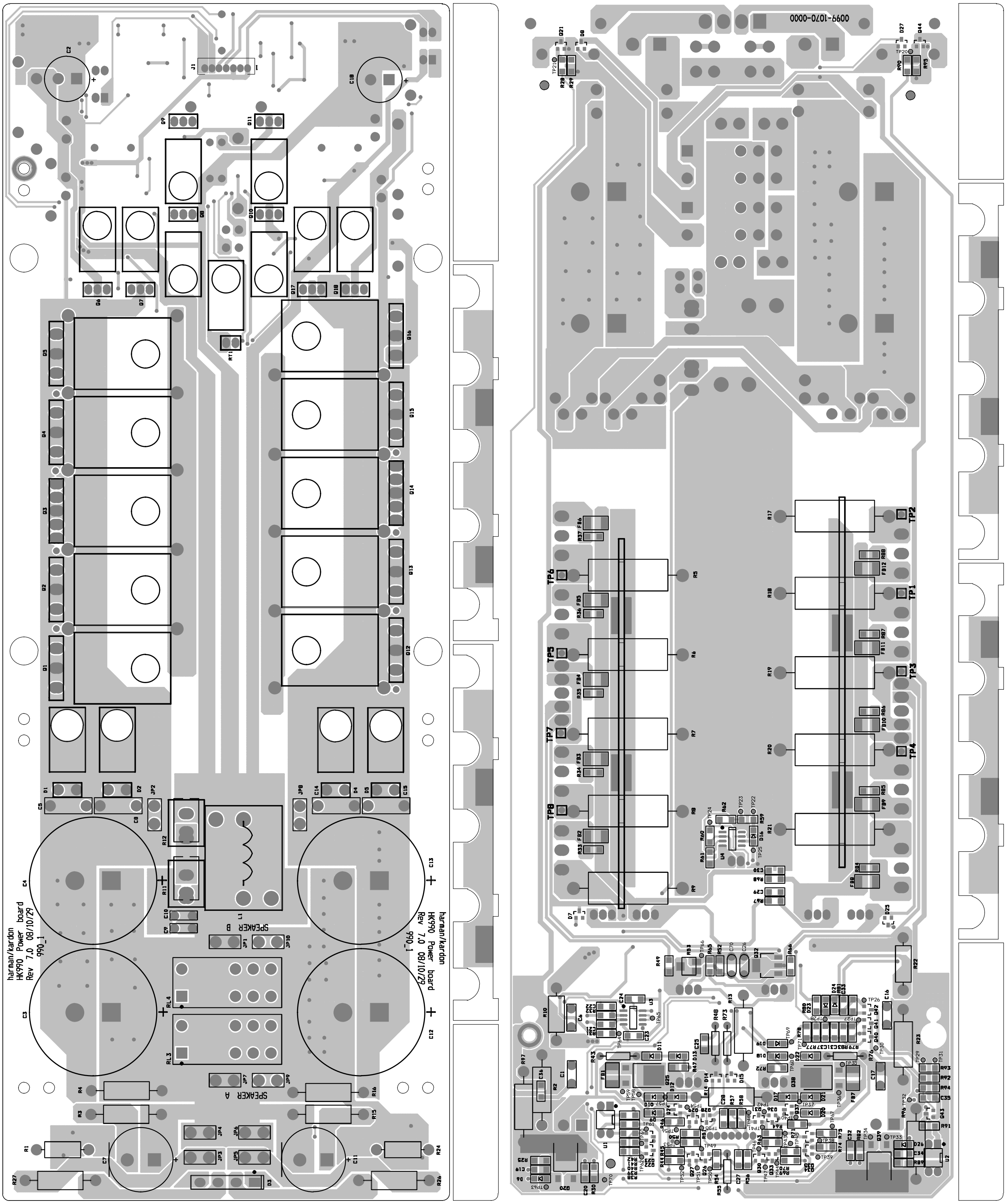
SOT-223

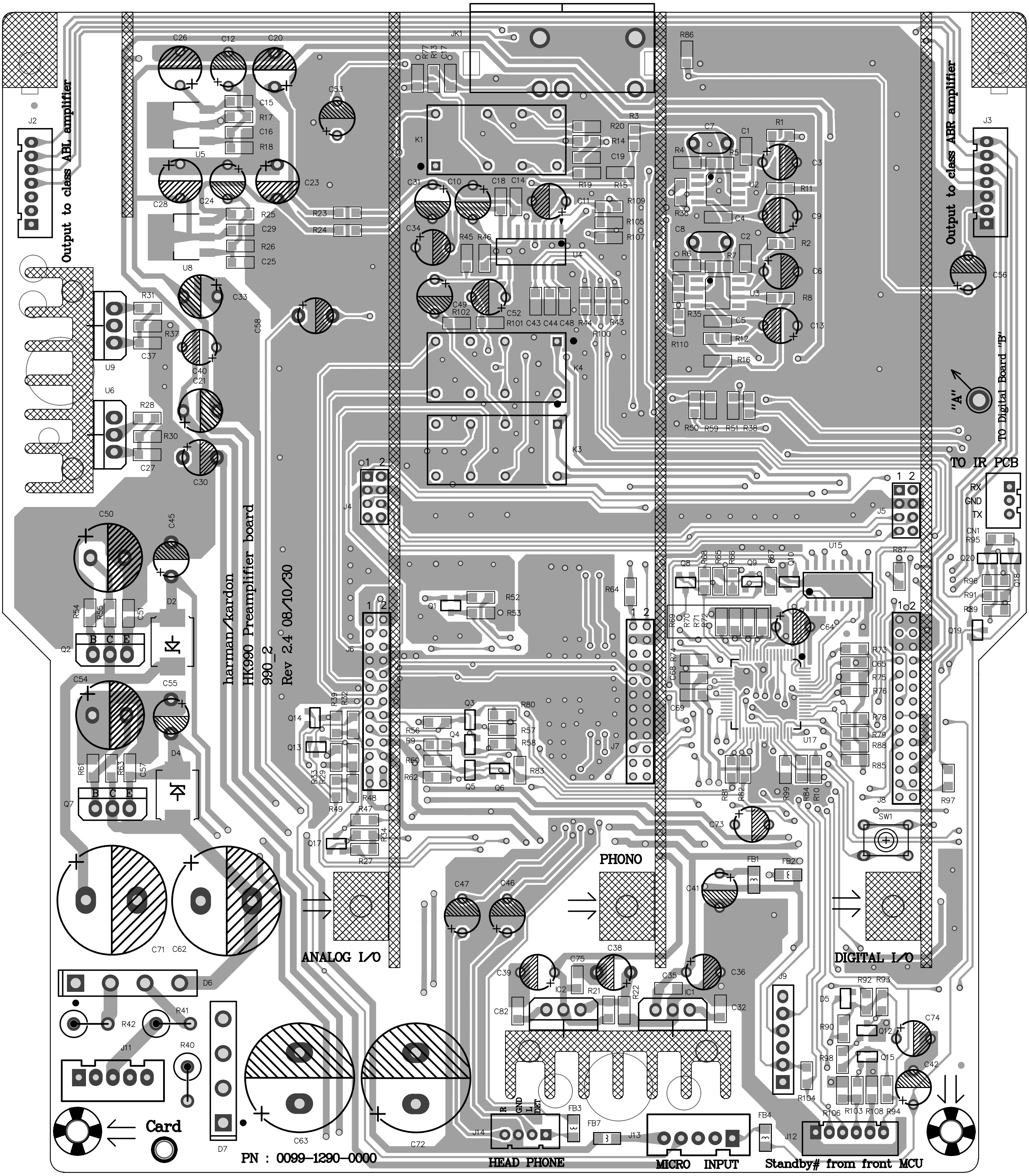

harman/kardon
HK990 Digital board
990_2
Rev 4.4 08/10/30
P/N:0099-1160-0000
Card


C2
C5
C114
C112
IO Preamp Board "A"
"B"

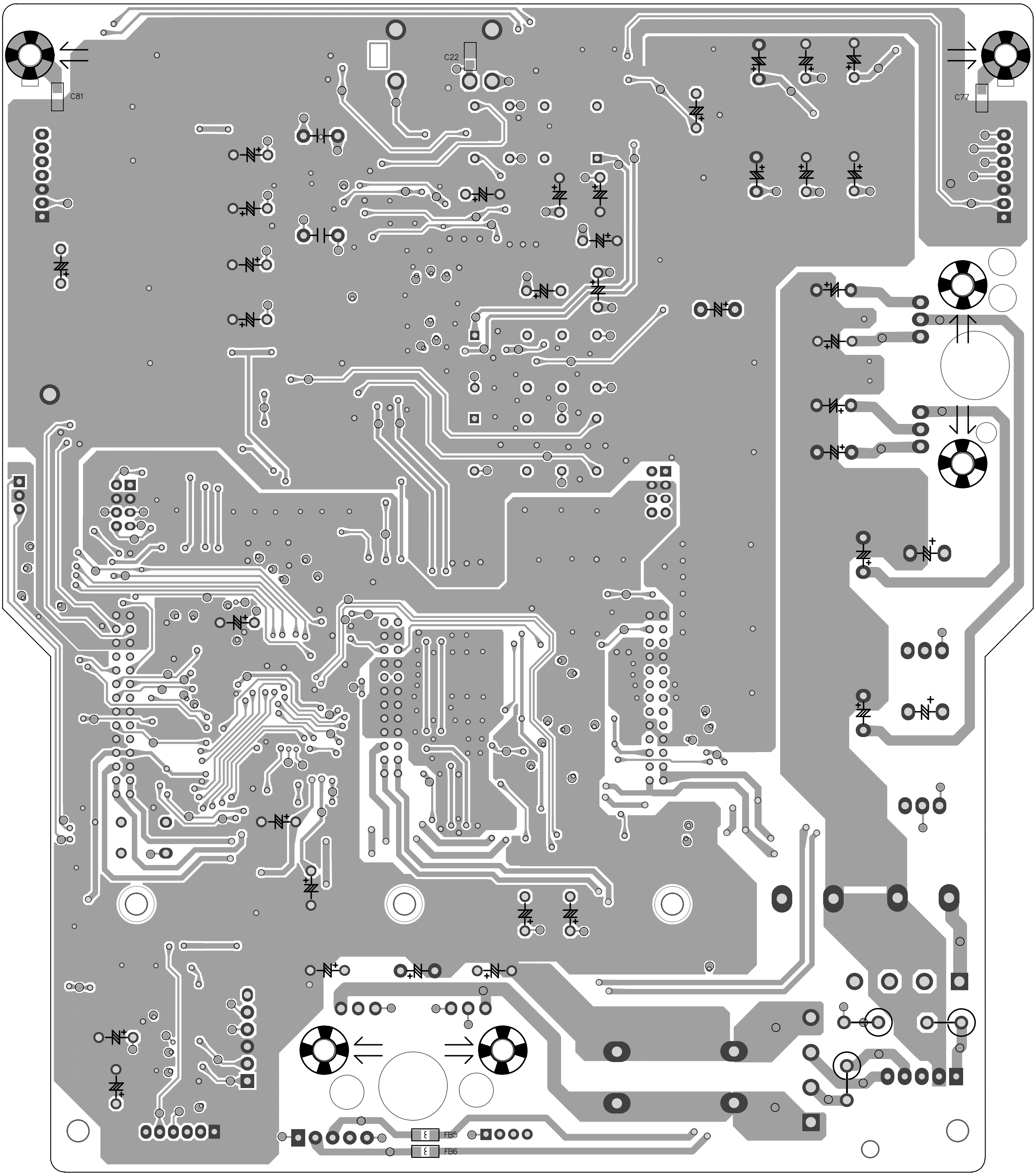

harman/kardon
HK990 phones board
990_2
Rev 4.5 08/10/30
P/N:0099-1171-0000
lead-free
Pb
Card
CN13
CN12
C40
C35
R23
C31
R31
C9
R29
R25
IC5
R26
C7
C10
R28
C32
R24
C41
C36
RELAY1
R30
R22
R18
R19
C38
R32
R4
C4
R3
R17
C29
C30
R20
R15
D4
Q2
CK1

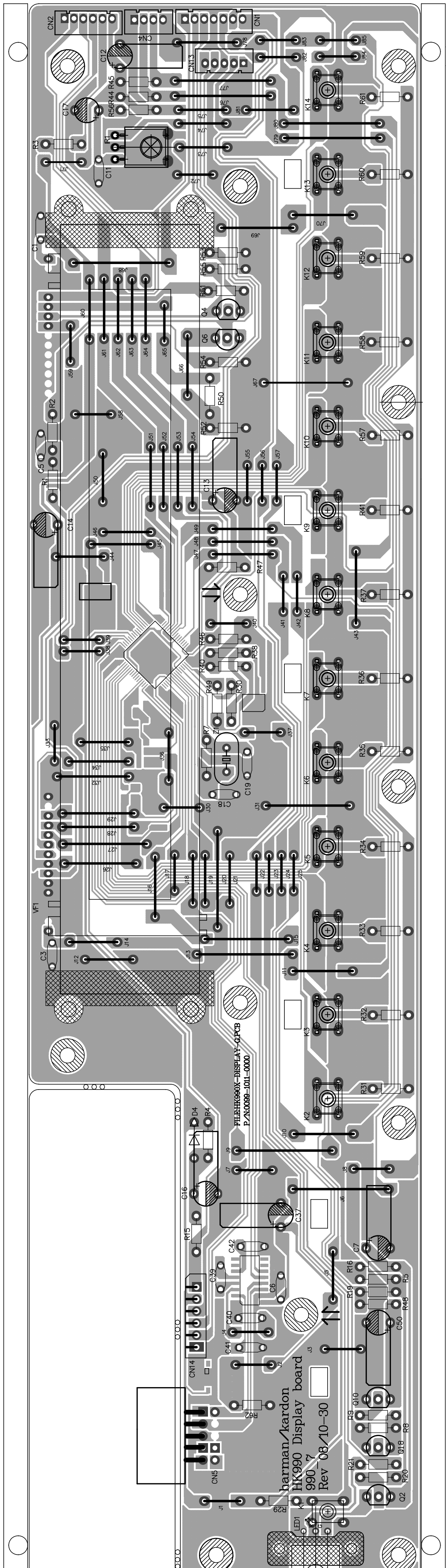

P/N:0099-1171-0000
C42
R5
R2
IC4
R1
R7
R9
R12
R11
C3
C1
C2
R14
R8
R10
R13
C5

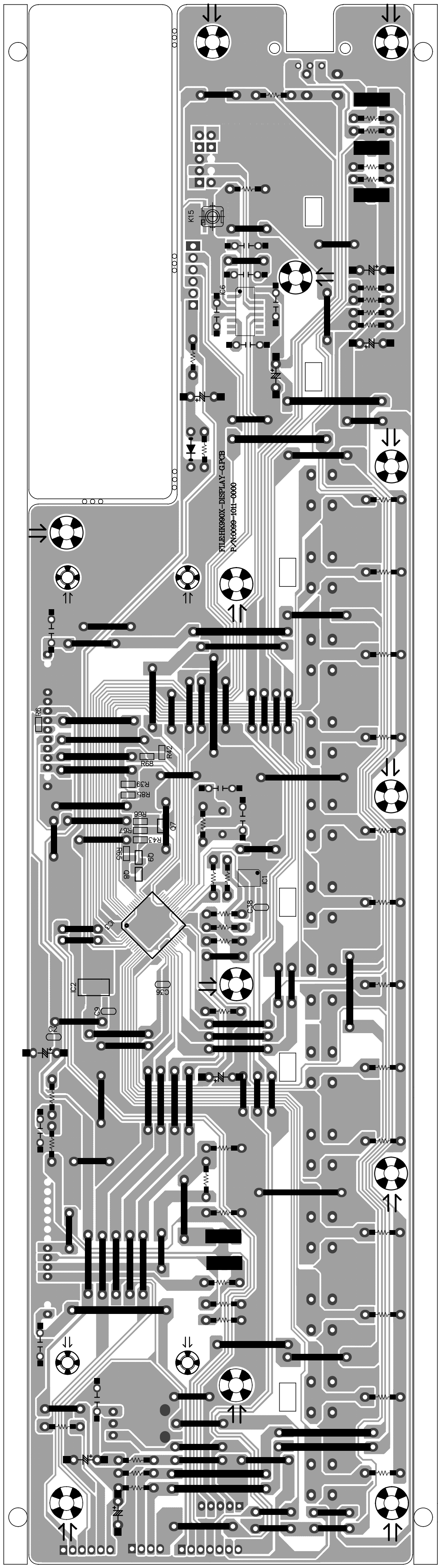


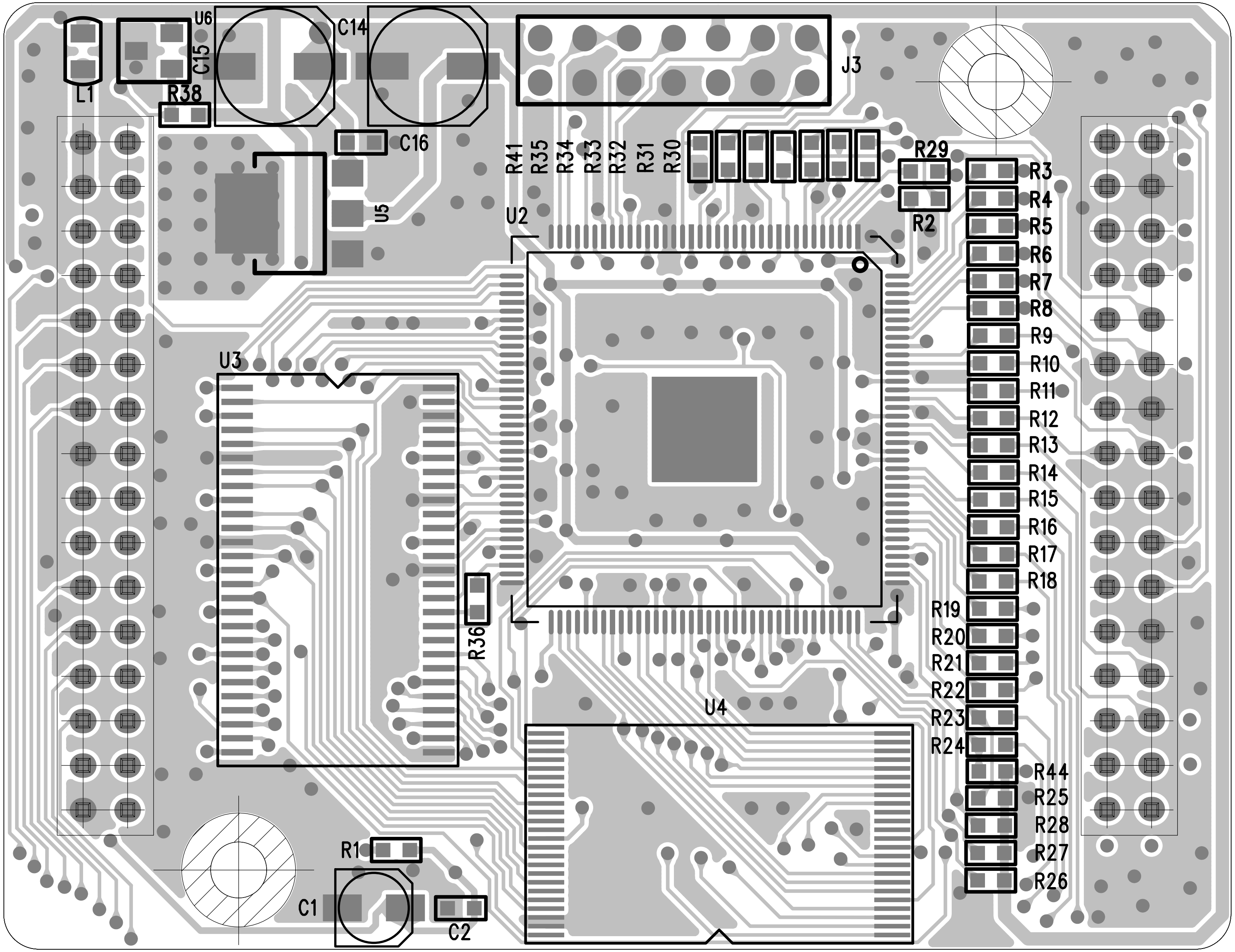


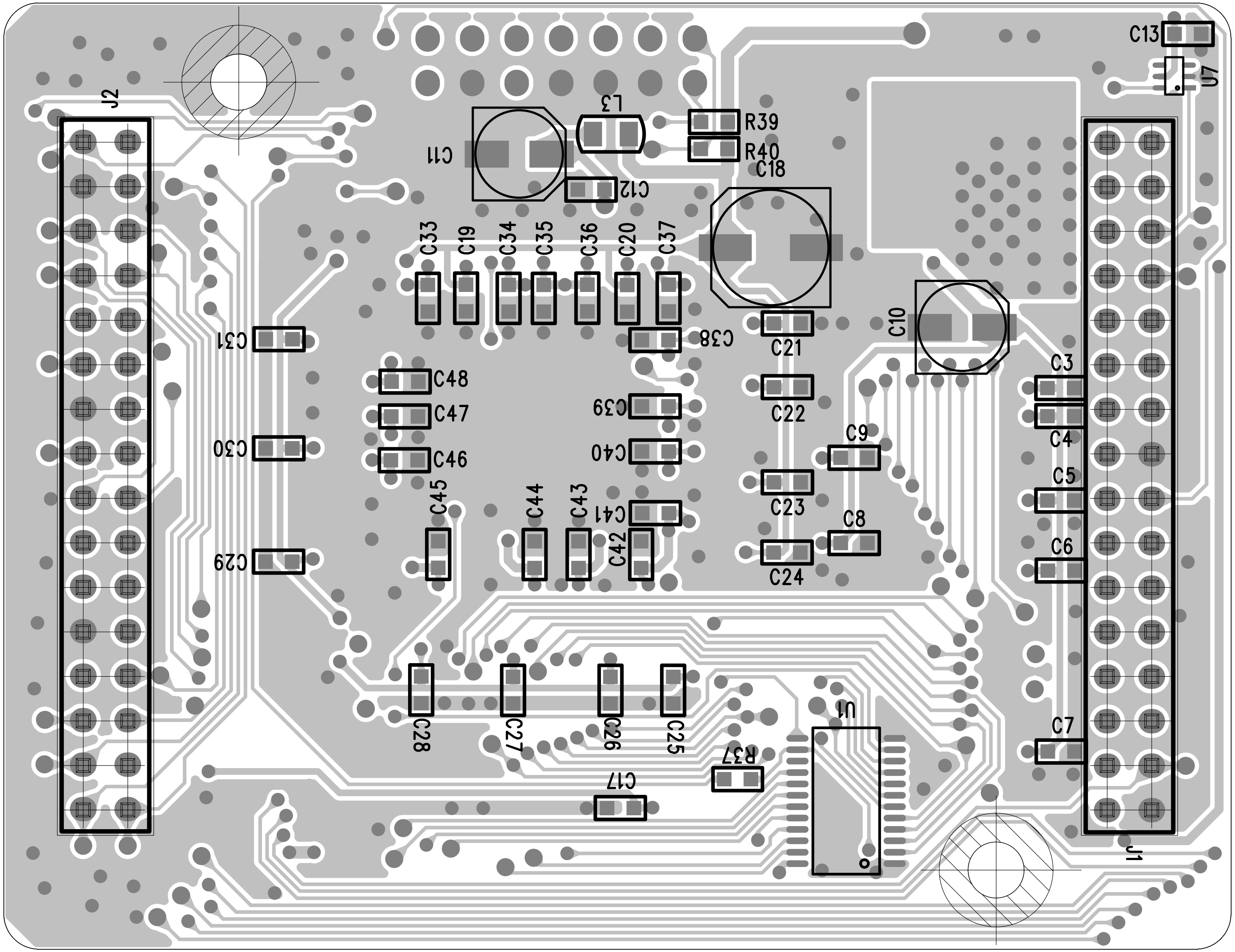
Output to class ABL amplifier
Output to class ABR amplifier
harman/kardon
HK990 Preamplifier board
990_2
Rev 2.4 08/10/30
TO IR PCB
RX
GND
TX
TO Digital Board "B"
"A"
ANALOG I/O
PHONO
DIGITAL I/O
Card
PN : 0099-1290-0000
HEAD PHONE
MICRO INPUT
Standby# from front MCU

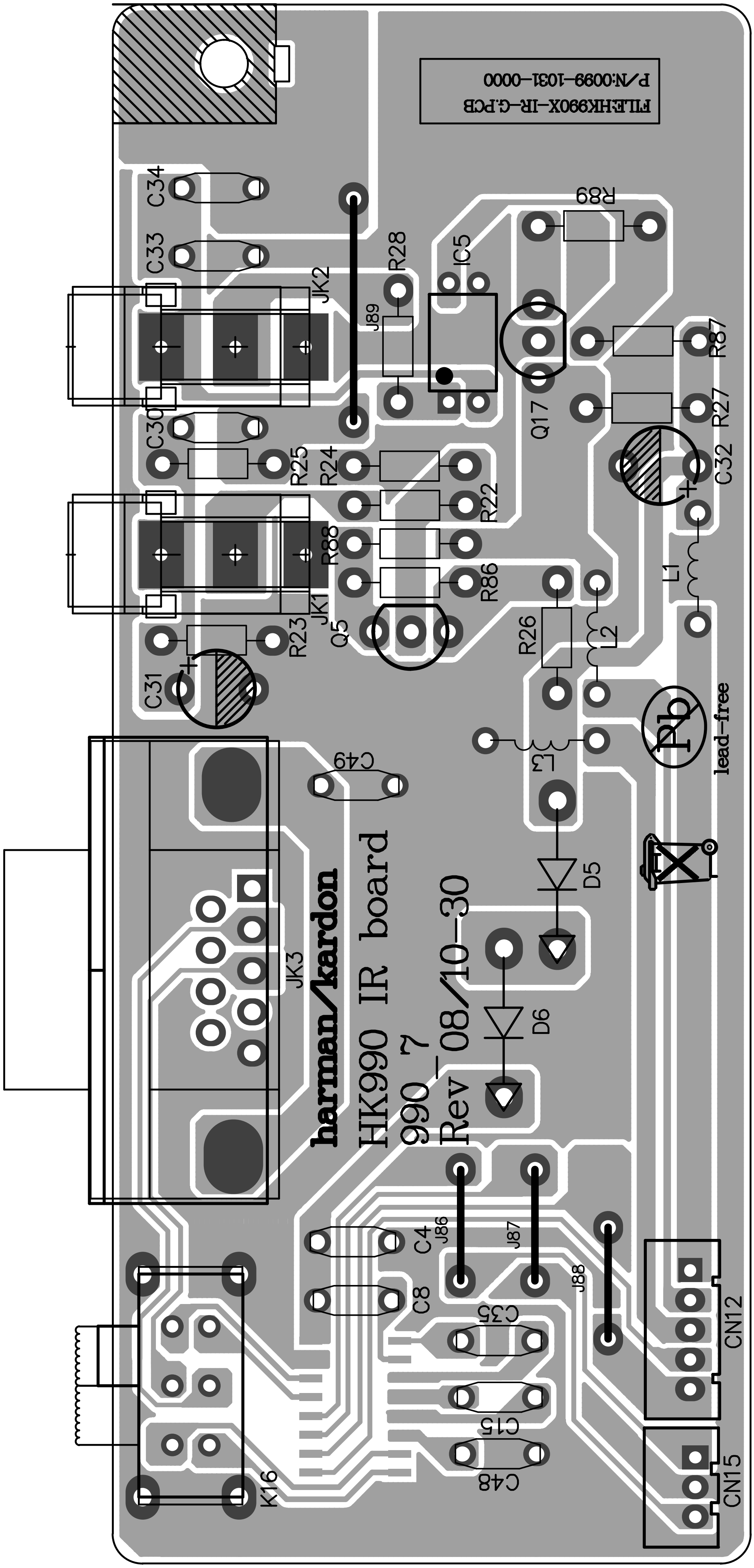

C81
C22
C77
FB5
FB6

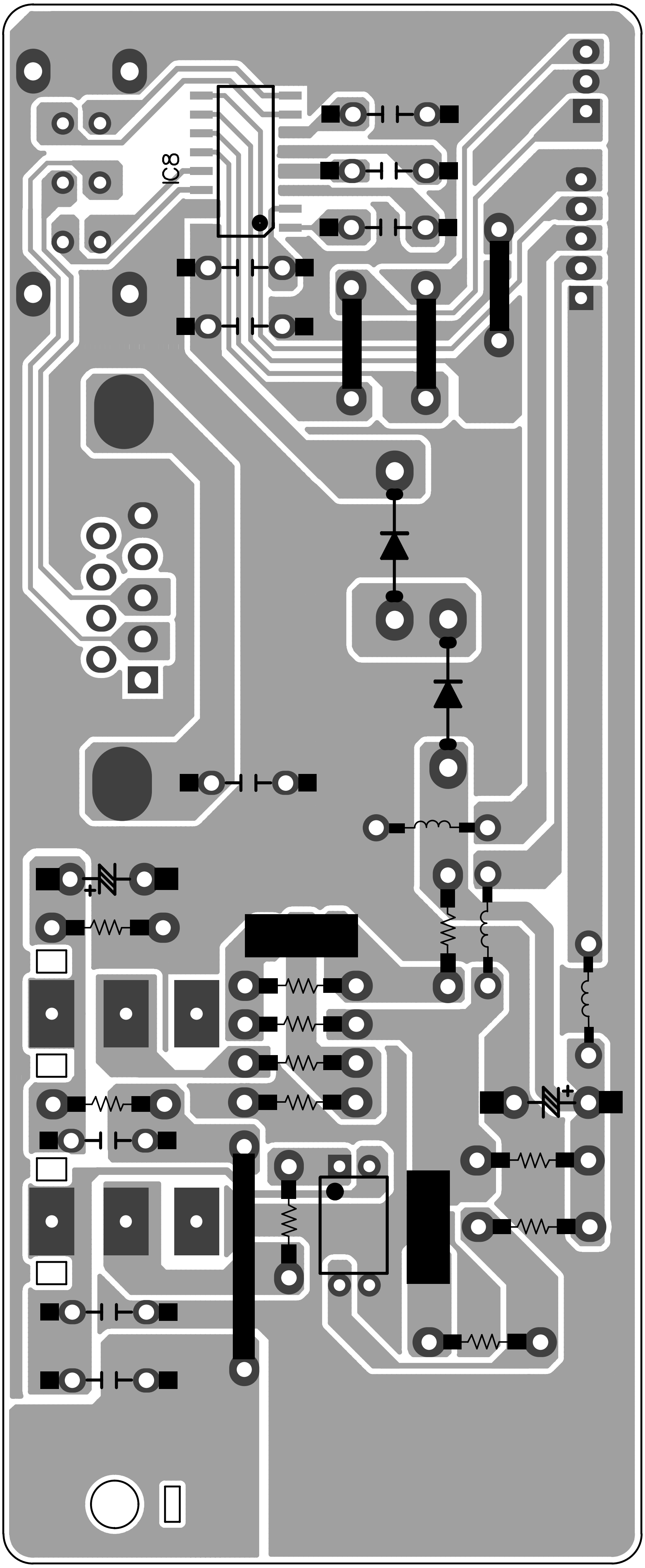

harman/kardon
HK990 Display board
990 7
Rev 08/10-30
FILE:HK990N-DISPLAY-01PCB
P/N:0099-1011-0000

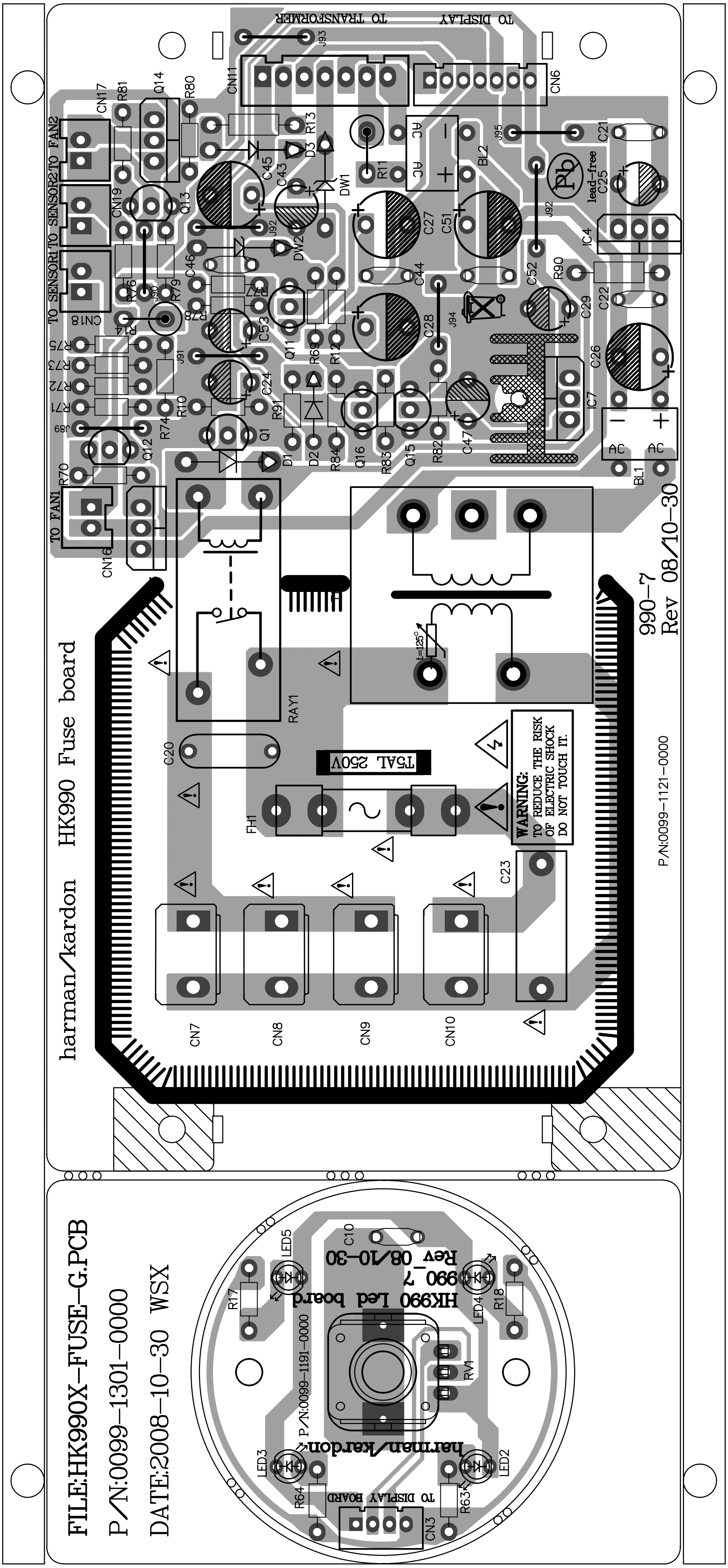


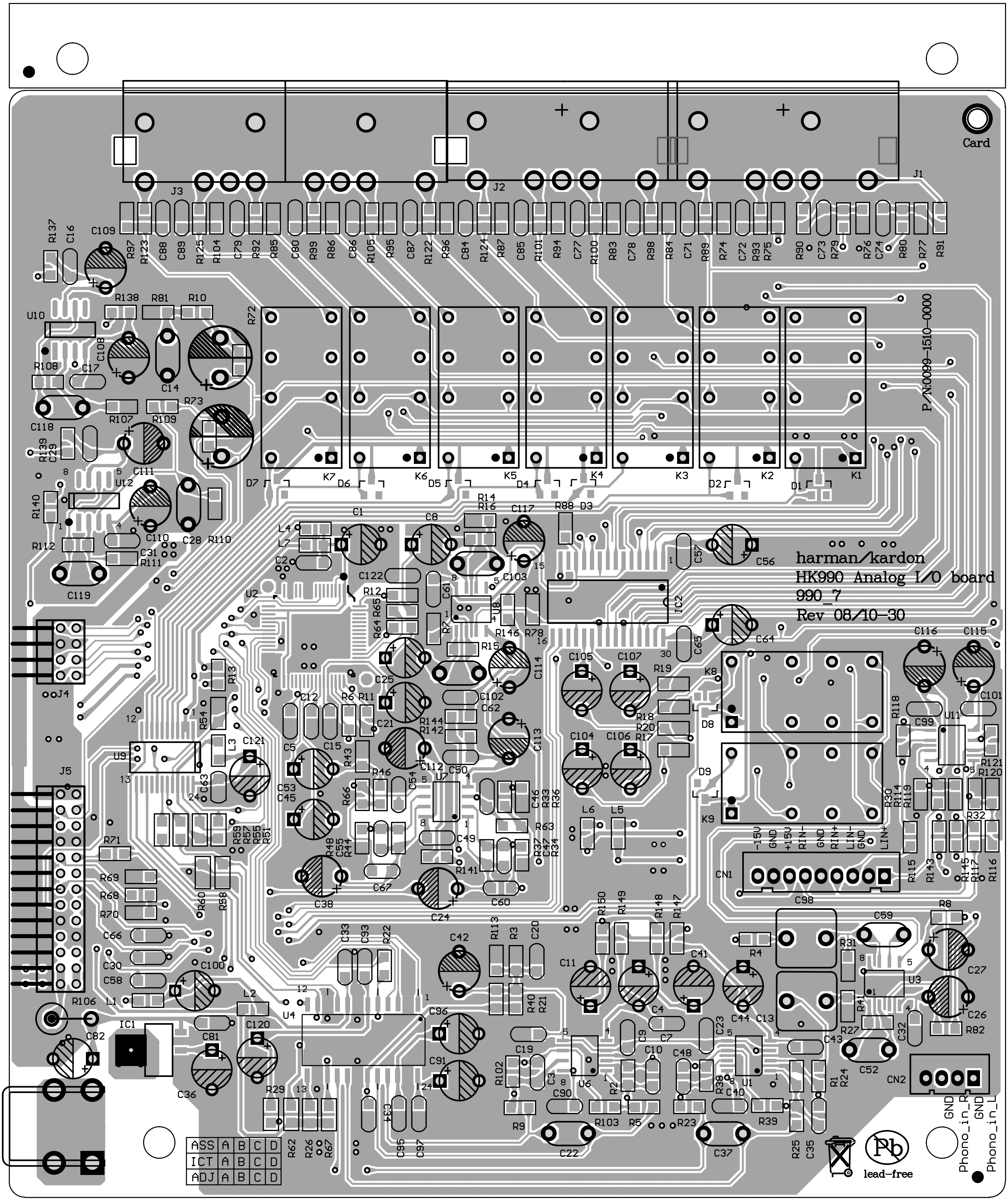

U6
C15
C14
L1
R38
C16
U5
J3
R41
R35
R34
R33
R32
R31
R30
R29
R2
U2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
U3
R36
R19
R20
R21
R22
R23
R24
U4
R44
R25
R28
R27
R26
R1
C1
C2

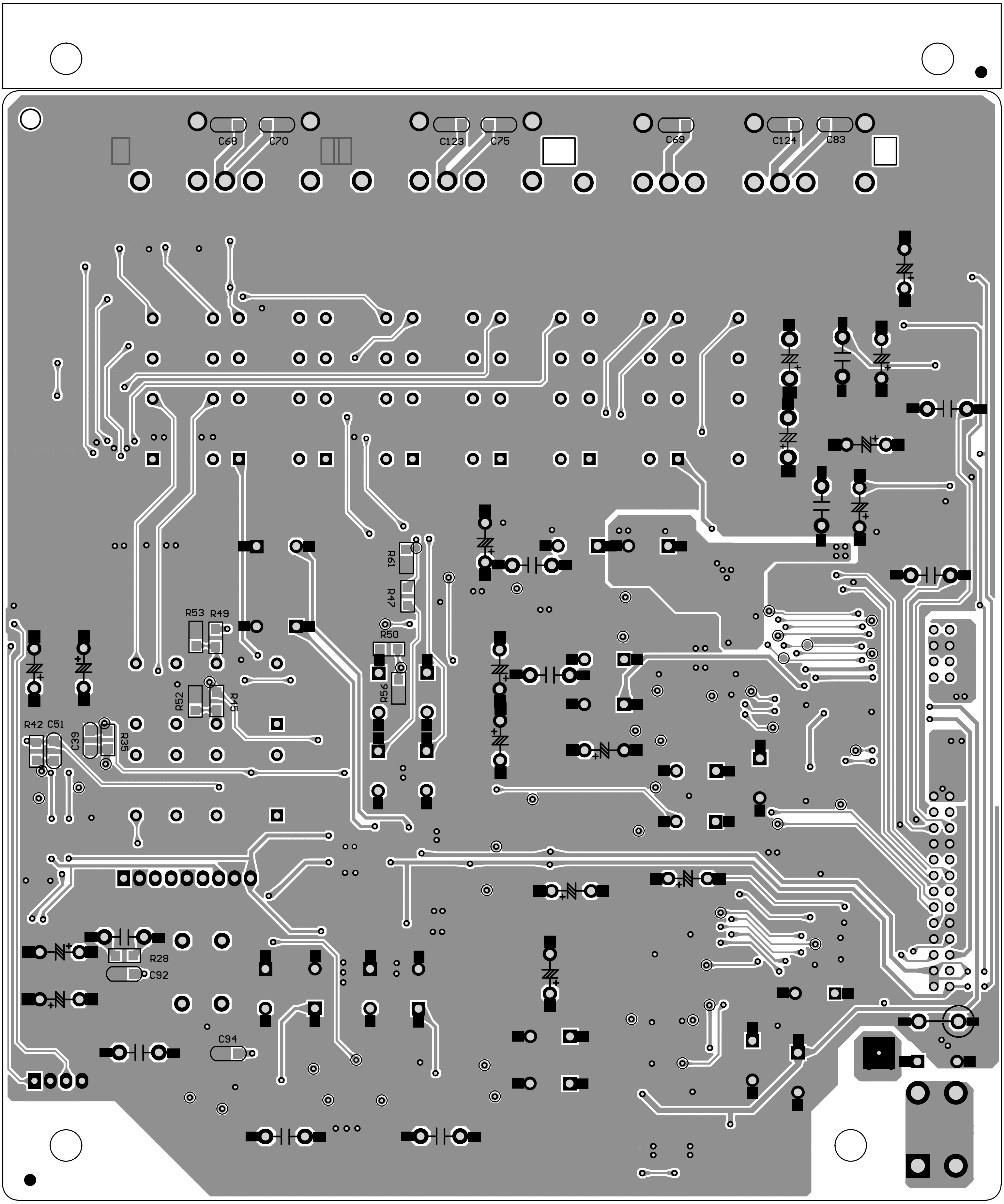

J2
J1
C13
U7
L3
R39
R40
C11
C12
C18
C33
C19
C34
C35
C36
C20
C37
C10
C31
C38
C21
C48
C3
C47
C39
C22
C4
C9
C30
C40
C46
C5
C45
C44
C43
C41
C23
C8
C42
C6
C29
C24
U1
C7
C28
C27
C26
C25
R37
C17

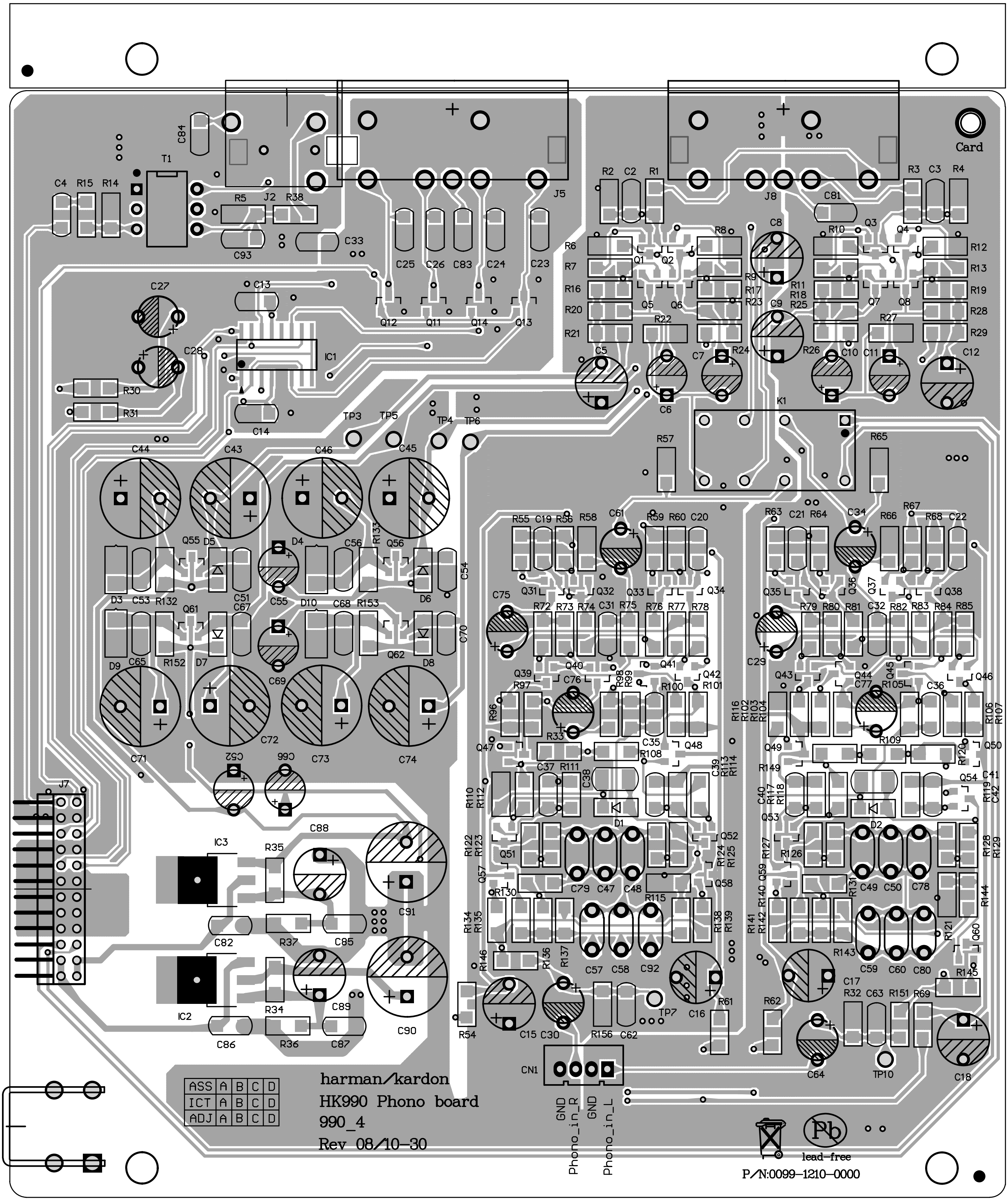

FILE:HK990X-IR-G.PCB
P/N:0099-1031-0000
harman/kardon
HK990 IR board
990_7
Rev 08/10-30
lead-free
Pb
JK1
JK2
JK3
K16
CN12
CN15
IC5
Q5
Q17
D5
D6
L1
L2
L3
C4
C8
C15
C30
C31
C32
C33
C34
C35
C48
C49
R22
R23
R24
R25
R26
R27
R28
R86
R87
R88
R89
J86
J87
J88
J89

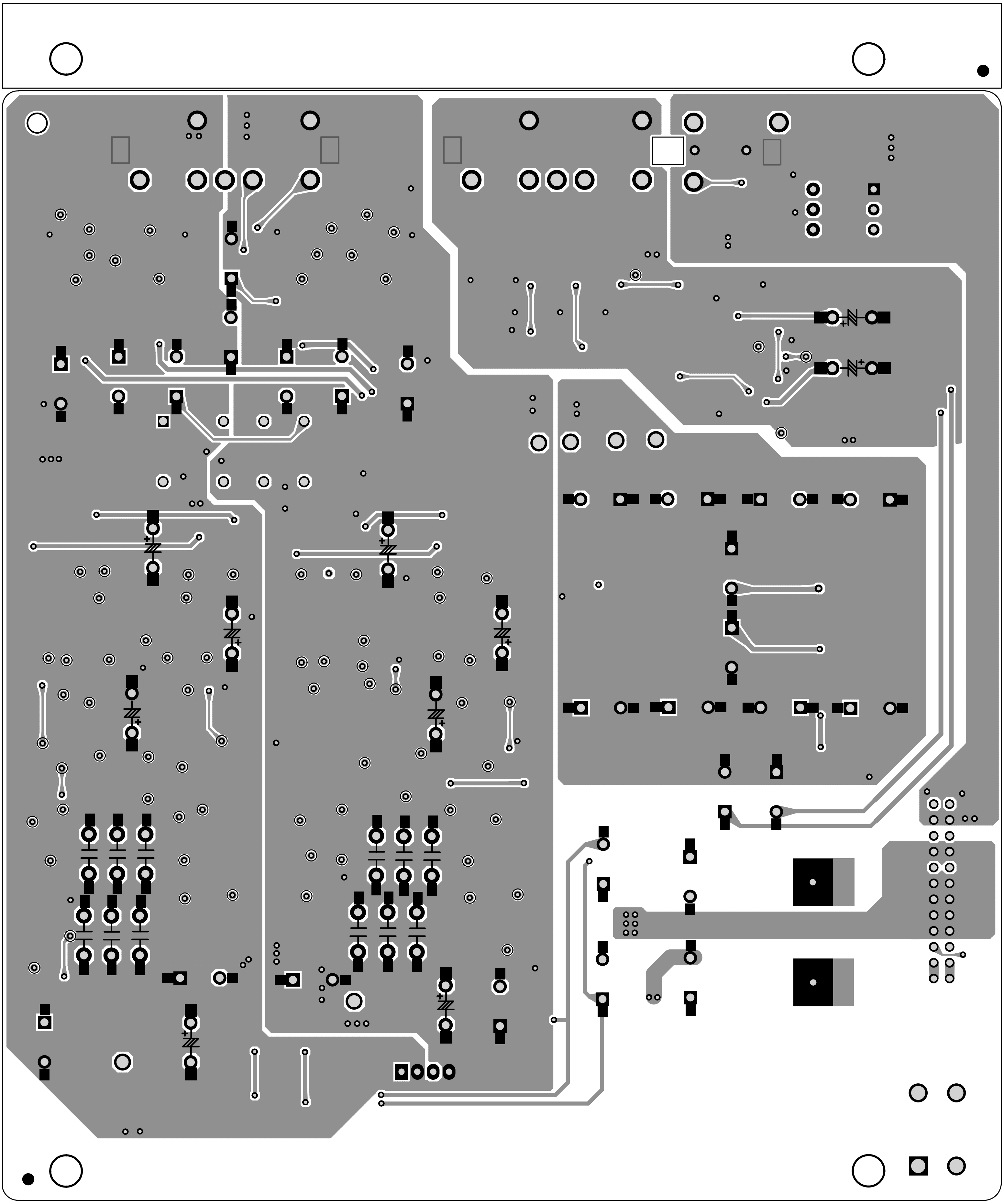

IC8

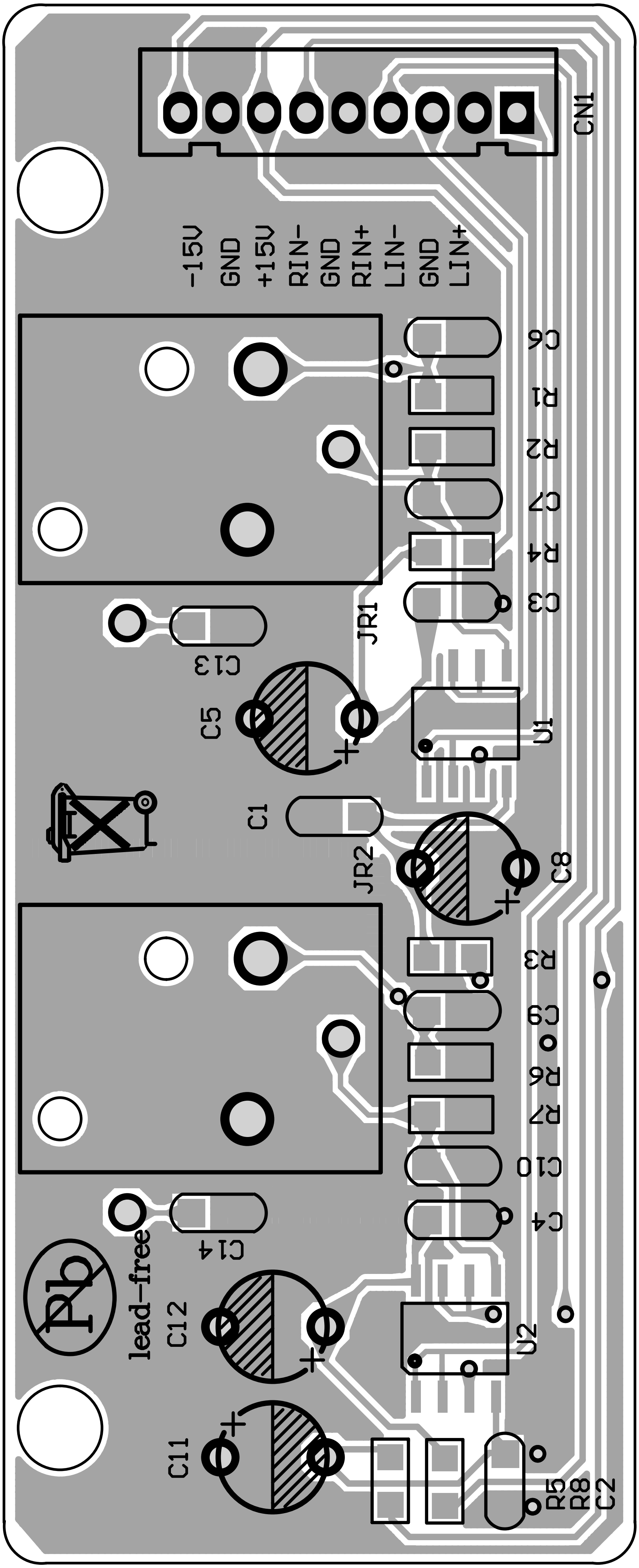

harman/kardon HK990 Fuse board
990-7
Rev 08/10-30
WARNING:
TO REDUCE THE RISK
OF ELECTRIC SHOCK
DO NOT TOUCH IT.
T5AL 250V
P/N:0099-1121-0000
TO TRANSFORMER
TO DISPLAY
TO SENSOR1
TO SENSOR2
TO FAN2
TO FAN1
lead-free
FILE:HK990X-FUSE-G.PCB
P/N:0099-1301-0000
DATE:2008-10-30 WSX
HK990 Led board
990_7
Rev_08/10-30
harman/kardon
P/N:0099-1191-0000
TO DISPLAY BOARD

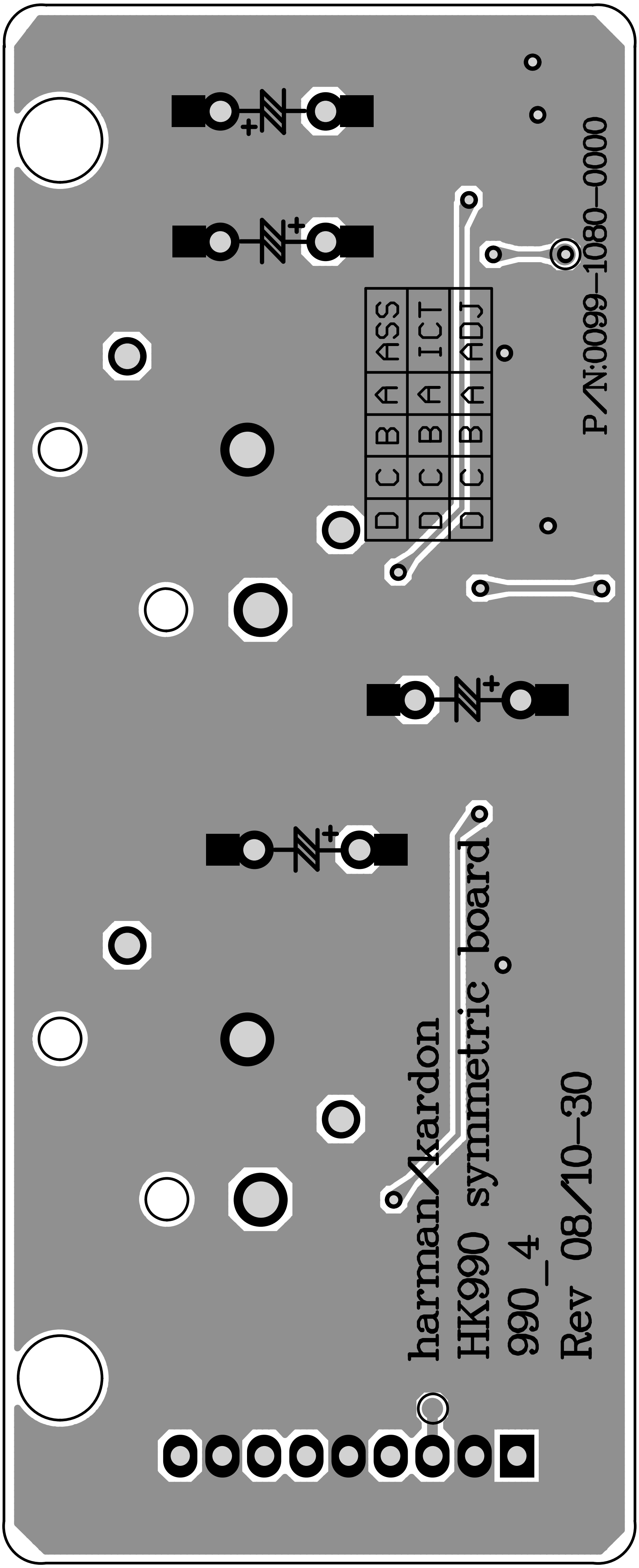

harman/kardon
HK990 Analog I/O board
990_7
Rev 08/10-30
P/N:0099-1510-0000
lead-free
Card


C68
C70
C123
C75
C69
C124
C83
R61
R47
R50
R53
R49
R56
R52
R45
R42
C51
C39
R35
R28
C92
C94

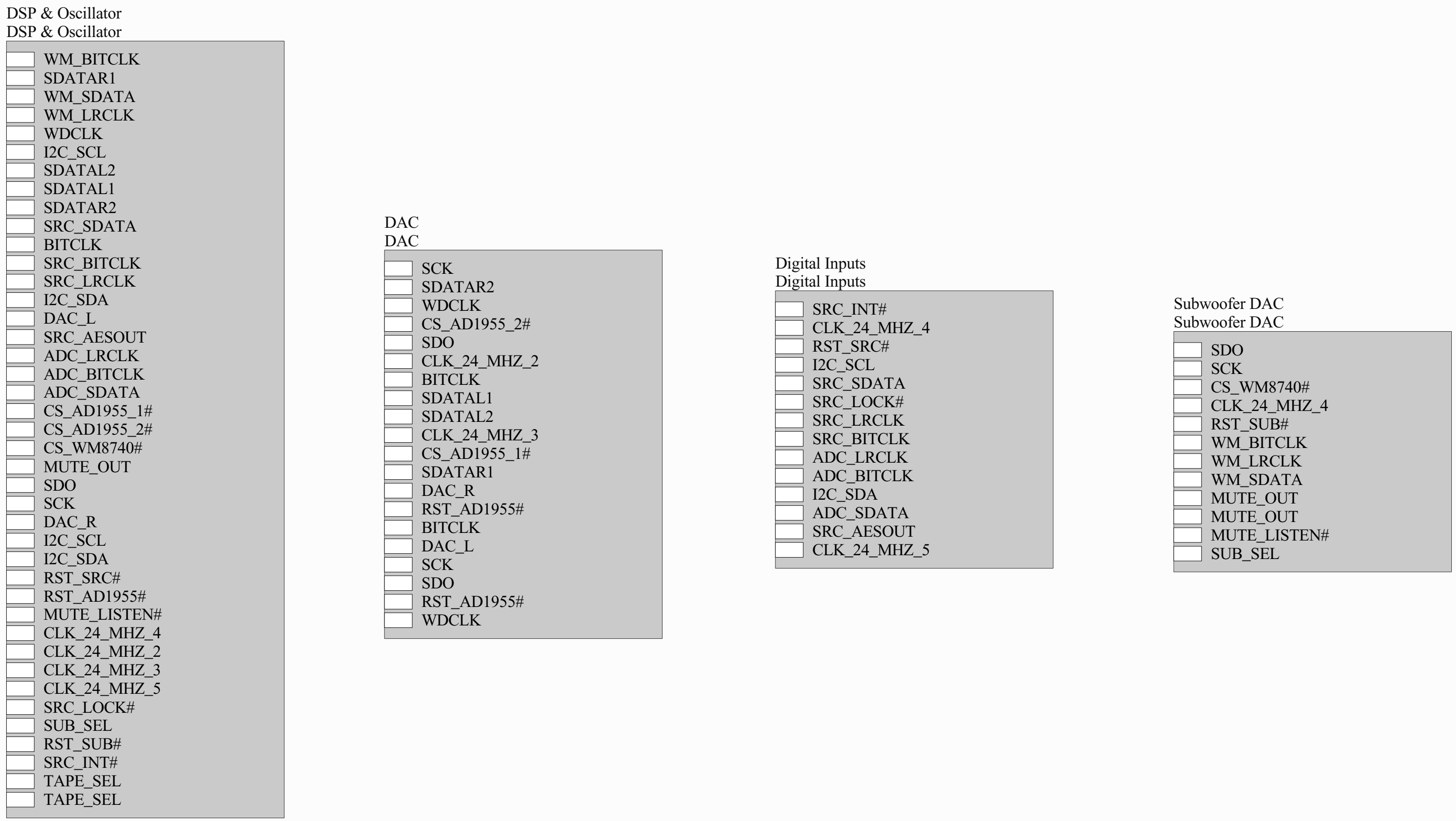

harman/kardon
HK990 Phono board
990_4
Rev 08/10-30
ASS A B C D
ICT A B C D
ADJ A B C D
Card
lead-free
P/N:0099-1210-0000
Phono_in_R
GND
GND
Phono_in_L
CN1
J2
J5
J7
J8
K1
T1
IC1
IC2
IC3
TP3
TP4
TP5
TP6
TP7
TP10

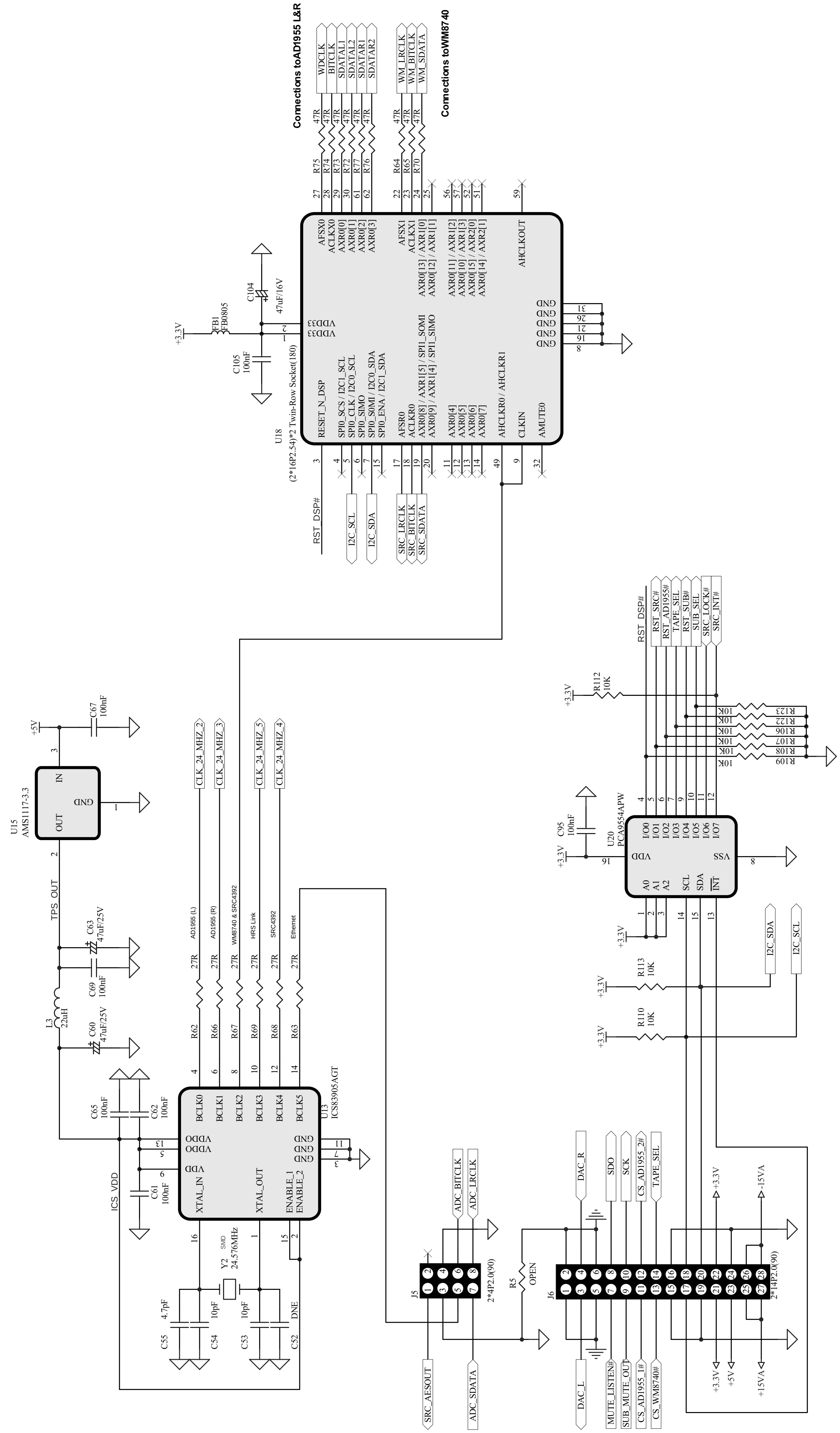


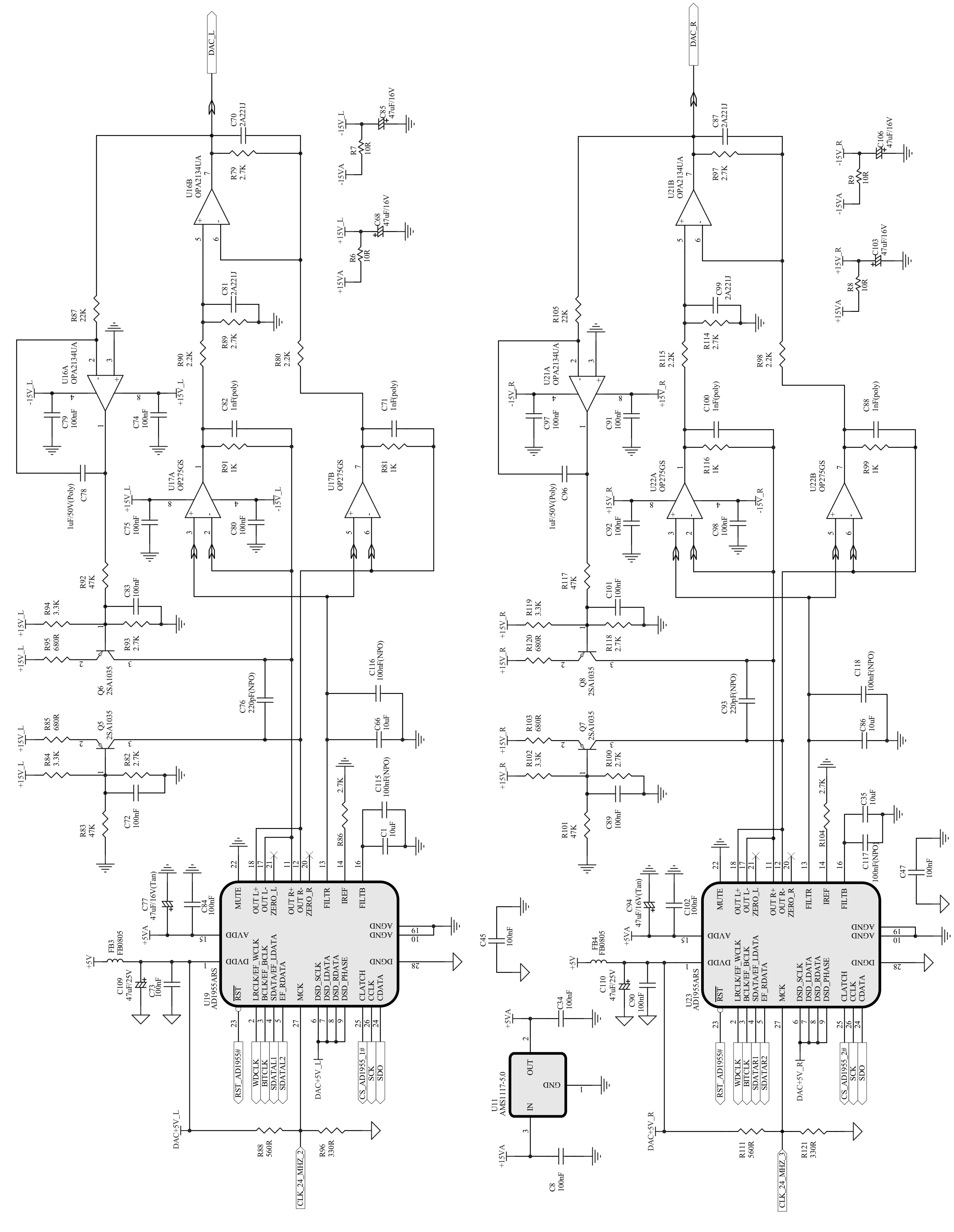

CN1
-15V
GND
+15V
RIN-
GND
RIN+
LIN-
GND
LIN+
C6
R1
R2
C7
R4
C3
JR1
C13
C5
U1
C1
JR2
C8
R3
C9
R6
R7
C10
C4
C14
C12
U2
C11
R5
R8
C2
Pb
lead-free

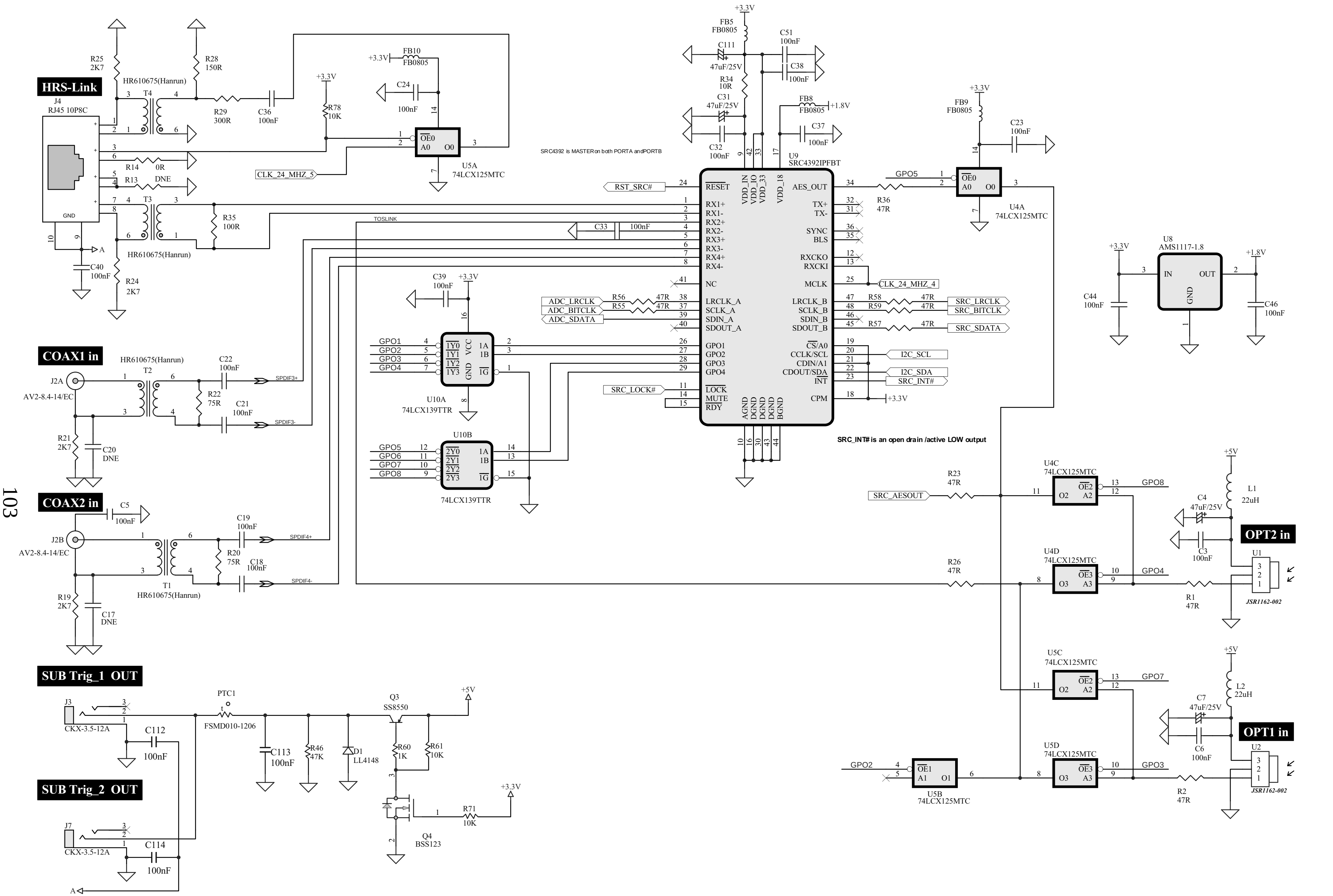

harman/kardon
HK990 symmetric board
990_4
Rev 08/10-30
P/N:0099-1080-0000
ASS A B C D
ICT A B C D
ADJ A B C D

100

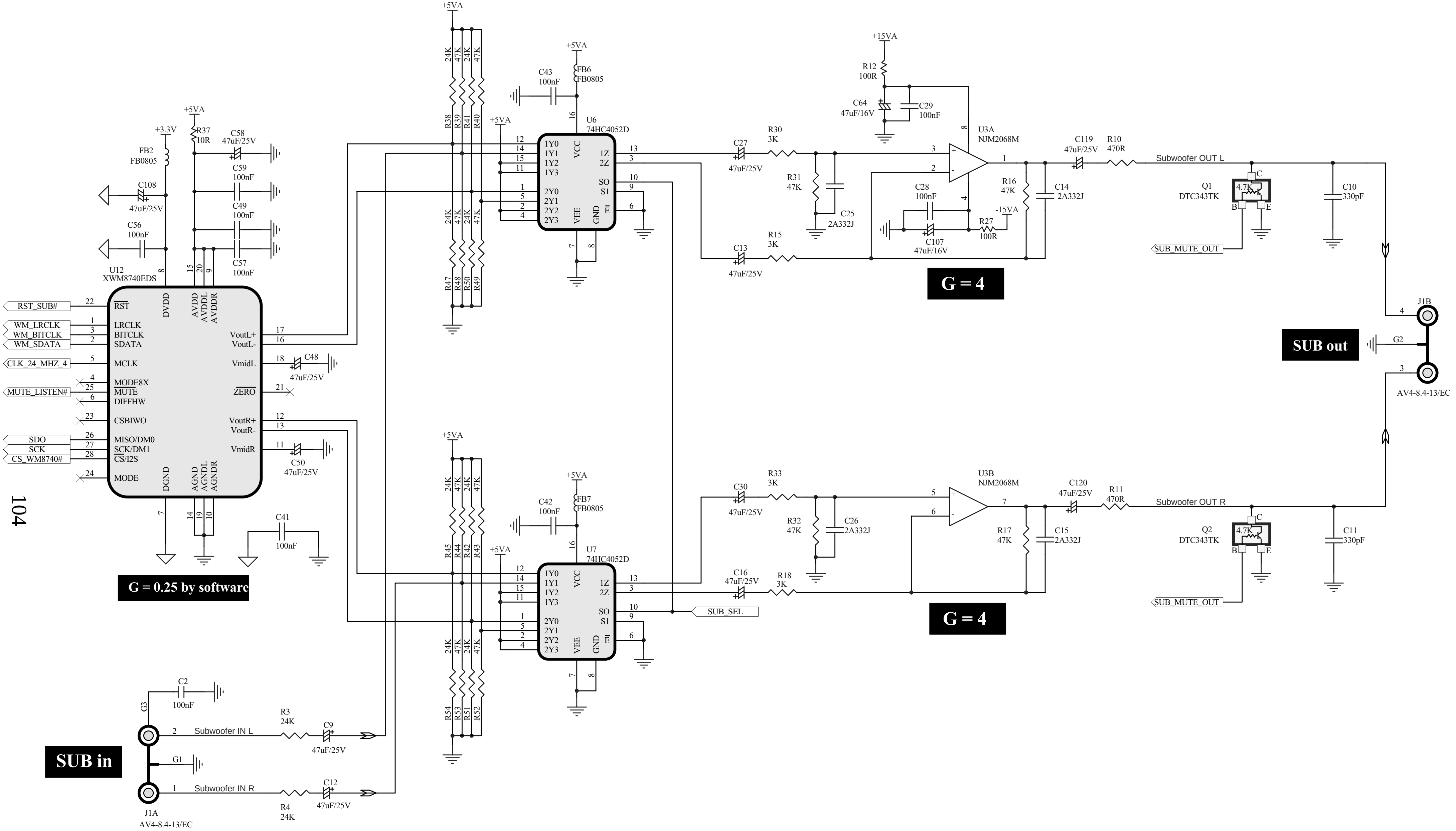

DSP & Oscillator
DSP & Oscillator
WM_BITCLK
SDATAR1
WM_SDATA
WM_LRCLK
WDCLK
I2C_SCL
SDATAL2
SDATAL1
SDATAR2
SRC_SDATA
BITCLK
SRC_BITCLK
SRC_LRCLK
I2C_SDA
DAC_L
SRC_AESOUT
ADC_LRCLK
ADC_BITCLK
ADC_SDATA
CS_AD1955_1#
CS_AD1955_2#
CS_WM8740#
MUTE_OUT
SDO
SCK
DAC_R
I2C_SCL
I2C_SDA
RST_SRC#
RST_AD1955#
MUTE_LISTEN#
CLK_24_MHZ_4
CLK_24_MHZ_2
CLK_24_MHZ_3
CLK_24_MHZ_5
SRC_LOCK#
SUB_SEL
RST_SUB#
SRC_INT#
TAPE_SEL
TAPE_SEL
DAC
DAC
SCK
SDATAR2
WDCLK
CS_AD1955_2#
SDO
CLK_24_MHZ_2
BITCLK
SDATAL1
SDATAL2
CLK_24_MHZ_3
CS_AD1955_1#
SDATAR1
DAC_R
RST_AD1955#
BITCLK
DAC_L
SCK
SDO
RST_AD1955#
WDCLK
Digital Inputs
Digital Inputs
SRC_INT#
CLK_24_MHZ_4
RST_SRC#
I2C_SCL
SRC_SDATA
SRC_LOCK#
SRC_LRCLK
SRC_BITCLK
ADC_LRCLK
ADC_BITCLK
I2C_SDA
ADC_SDATA
SRC_AESOUT
CLK_24_MHZ_5
Subwoofer DAC
Subwoofer DAC
SDO
SCK
CS_WM8740#
CLK_24_MHZ_4
RST_SUB#
WM_BITCLK
WM_LRCLK
WM_SDATA
MUTE_OUT
MUTE_OUT
MUTE_LISTEN#
SUB_SEL

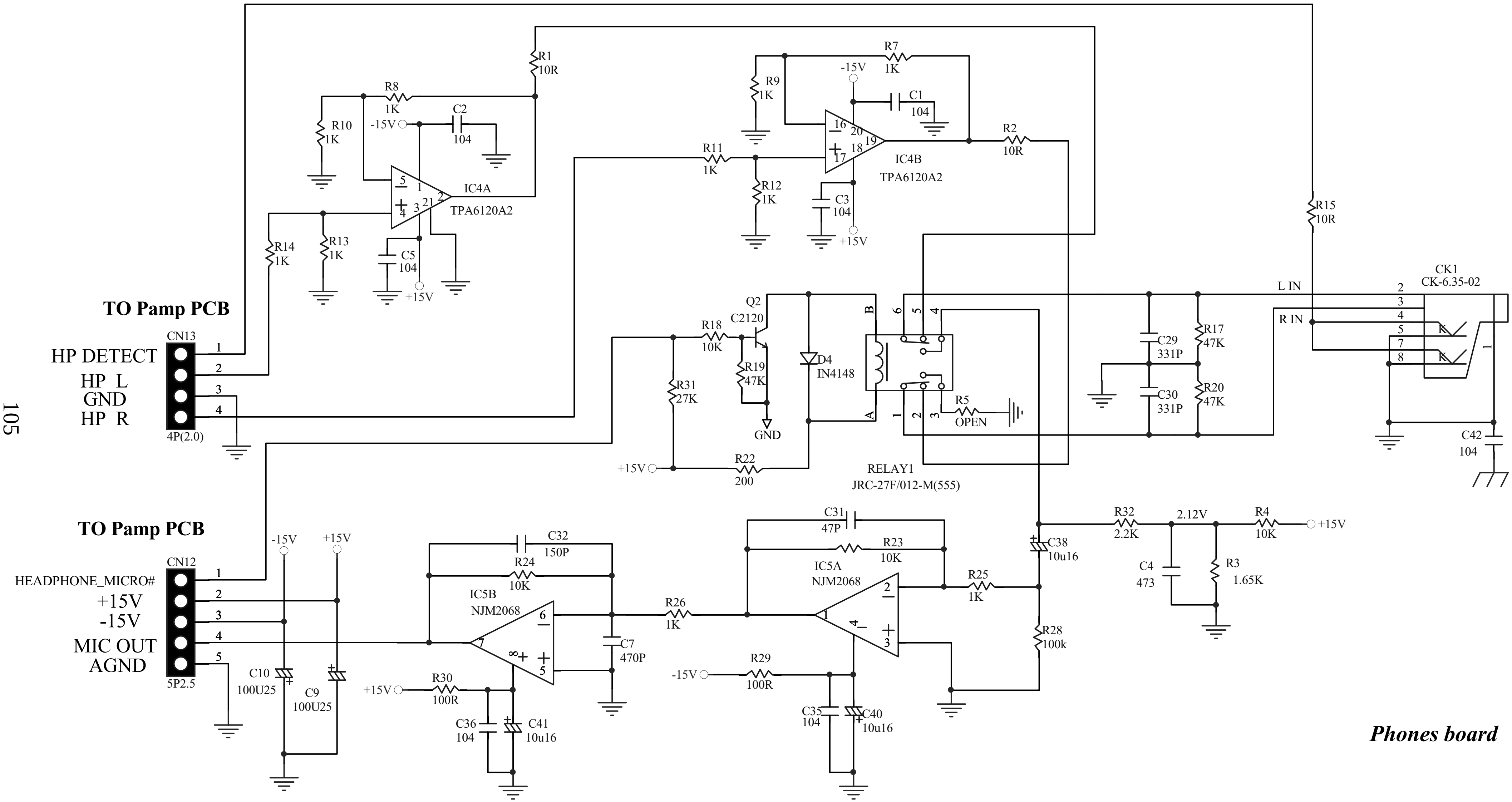

Connections toAD1955 L&R
Connections toWM8740
WDCLK
BITCLK
SDATAL1
SDATAL2
SDATAR1
SDATAR2
WM_LRCLK
WM_BITCLK
WM_SDATA
U18
(2*16P2.54)*2 Twin-Row Socket(180)
C104
47uF/16V
C105
100nF
FB1
FB0805
+3.3V
RST_DSP#
I2C_SCL
I2C_SDA
SRC_LRCLK
SRC_BITCLK
SRC_SDATA
U15
AMS1117-3.3
+5V
C67
100nF
TPS_OUT
C63
47uF/25V
C69
100nF
L3
22uH
C60
47uF/25V
C65
100nF
C62
100nF
C61
100nF
ICS_VDD
CLK_24_MHZ_2
CLK_24_MHZ_3
CLK_24_MHZ_5
CLK_24_MHZ_4
AD1955 (L)
AD1955 (R)
WM8740 & SRC4392
HRS Link
SRC4392
Ethernet
U13
ICS83905AGT
Y2
24.576MHz
C55
4.7pF
C54
10pF
C53
10pF
C52
DNE
RST_SRC#
RST_AD1955#
TAPE_SEL
RST_SUB#
SUB_SEL
SRC_LOCK#
SRC_INT#
R112
10K
U20
PCA9554APW
C95
100nF
R113
10K
R110
10K
I2C_SDA
I2C_SCL
ADC_BITCLK
ADC_LRCLK
J5
2*4P2.0(90)
SRC_AESOUT
ADC_SDATA
R5
OPEN
J6
2*14P2.0(90)
DAC_R
SDO
SCK
CS_AD1955_2#
TAPE_SEL
DAC_L
MUTE_LISTEN#
SUB_MUTE_OUT
CS_AD1955_1#
CS_WM8740#
+3.3V
-15VA
+5V
+15VA


DAC_L
DAC_R
U19 AD1955ARS
U23 AD1955ARS
U11 AMS1117-5.0
U16A OPA2134UA
U16B OPA2134UA
U21A OPA2134UA
U21B OPA2134UA
U17A OP275GS
U17B OP275GS
U22A OP275GS
U22B OP275GS
CLK_24_MHZ_2
CLK_24_MHZ_3

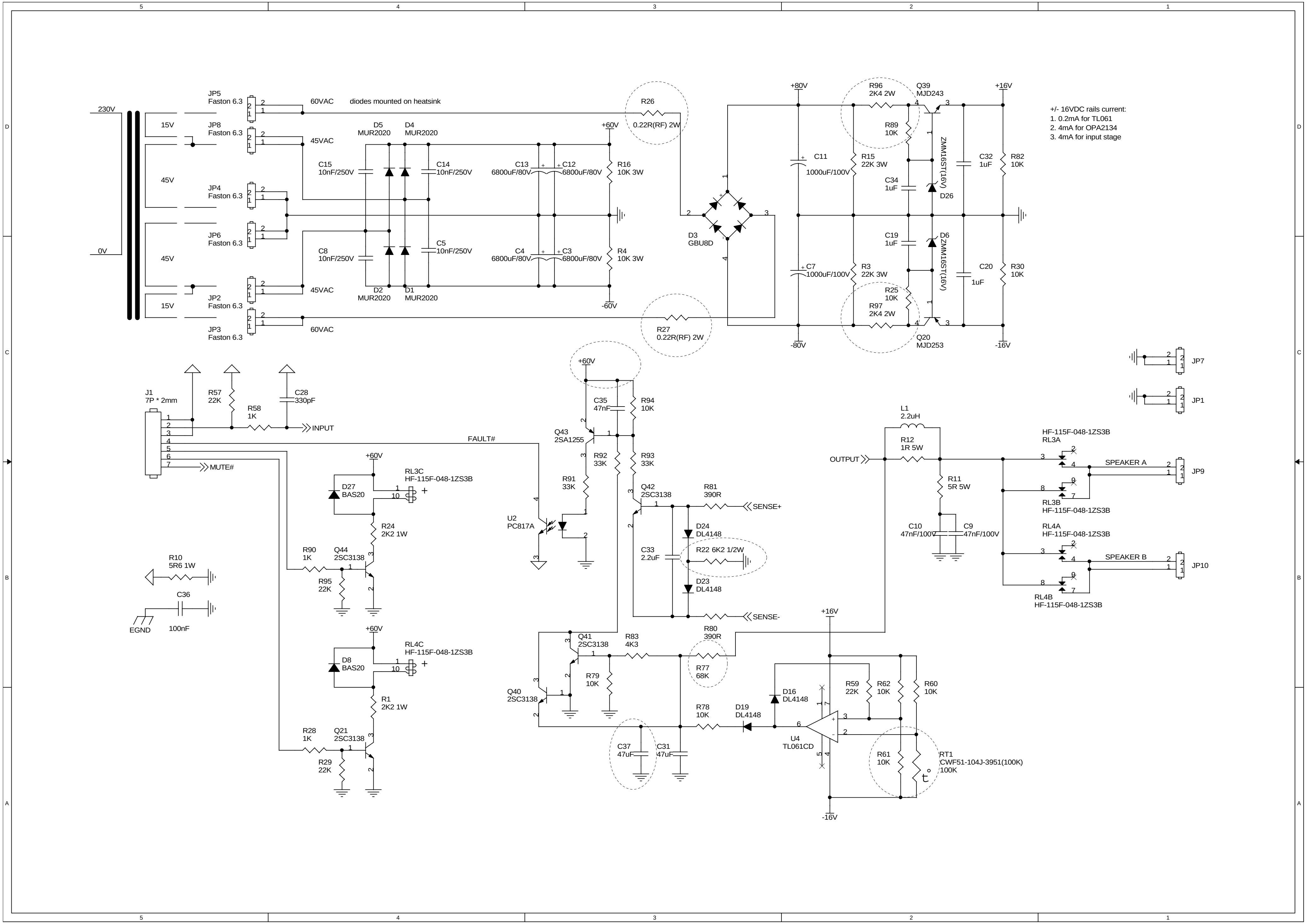


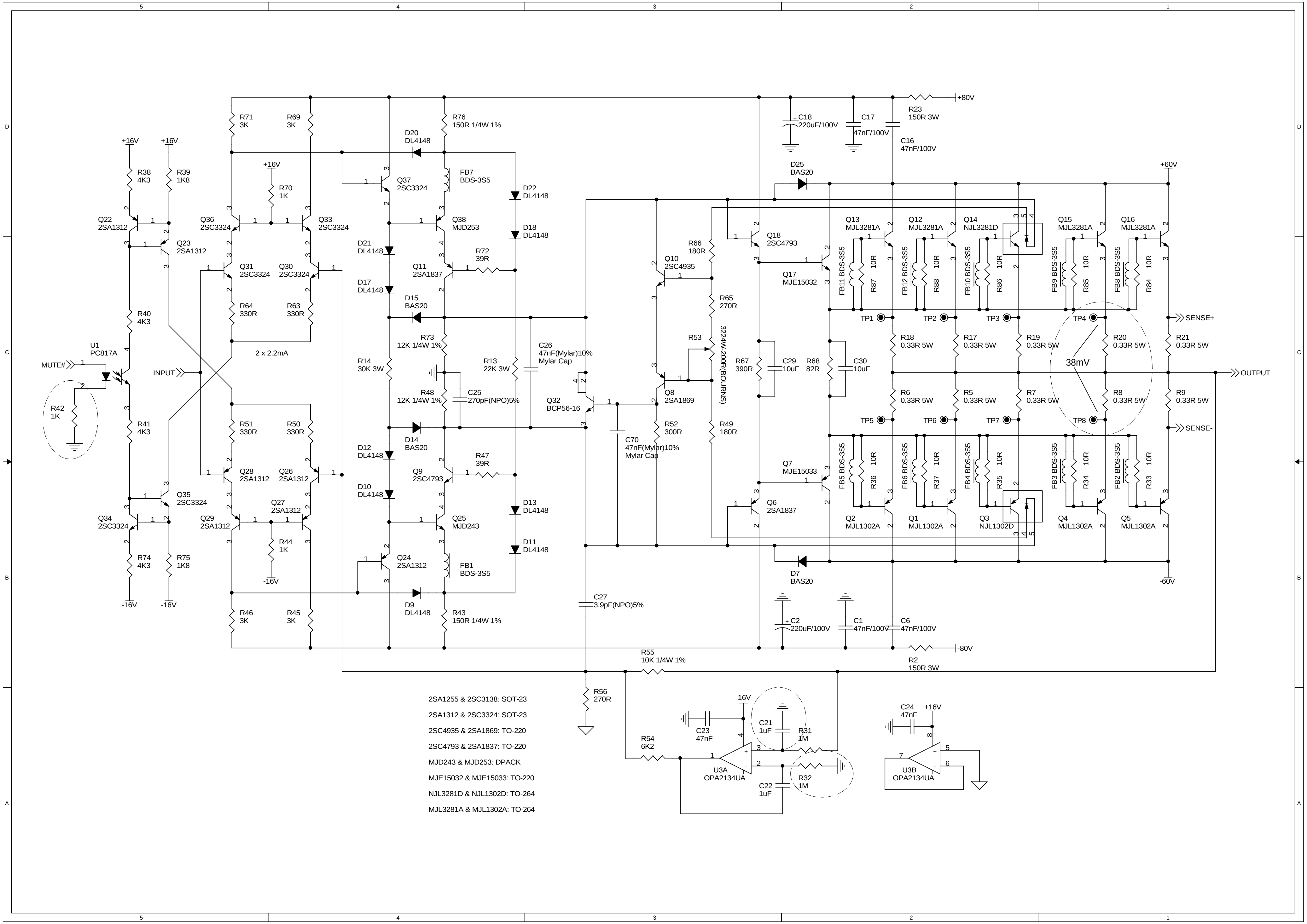
HRS-Link
J4
RJ45 10P8C
R25 2K7
R28 150R
HR610675(Hanrun)
T4
R29 300R
C36 100nF
R14 0R
R13 DNE
T3
R35 100R
R24 2K7
C40 100nF
+3.3V
R78 10K
FB10 FB0805
C24 100nF
CLK_24_MHZ_5
U5A 74LCX125MTC
SRC4392 is MASTER on both PORTA and PORTB
TOSLINK
C33 100nF
FB5 FB0805
C111 47uF/25V
R34 10R
C31 47uF/25V
C32 100nF
C51 100nF
C38 100nF
FB8 FB0805 +1.8V
C37 100nF
U9 SRC4392IPFBT
RST_SRC#
RESET
RX1+ RX1- RX2+ RX2- RX3+ RX3- RX4+ RX4-
NC
LRCLK_A SCLK_A SDIN_A SDOUT_A
GPO1 GPO2 GPO3 GPO4
LOCK MUTE RDY
AES_OUT TX+ TX- SYNC BLS RXCKO RXCKI MCLK
LRCLK_B SCLK_B SDIN_B SDOUT_B
CS/A0 CCLK/SCL CDIN/A1 CDOUT/SDA INT CPM
VDD_IN VDD_IO VDD_33 VDD_18
AGND DGND DGND DGND BGND
ADC_LRCLK ADC_BITCLK ADC_SDATA
R56 47R R55 47R
R58 47R R59 47R R57 47R
SRC_LRCLK SRC_BITCLK SRC_SDATA
CLK_24_MHZ_4
I2C_SCL I2C_SDA SRC_INT#
SRC_LOCK#
SRC_INT# is an open drain /active LOW output
GPO5
R36 47R
FB9 FB0805
C23 100nF
U4A 74LCX125MTC
U8 AMS1117-1.8
IN OUT GND
C44 100nF
C46 100nF
+1.8V
C39 100nF
U10A 74LCX139TTR
U10B 74LCX139TTR
COAX1 in
J2A AV2-8.4-14/EC
HR610675(Hanrun)
T2
C22 100nF
R22 75R
C21 100nF
SPDIF3+ SPDIF3-
R21 2K7
C20 DNE
COAX2 in
C5 100nF
J2B AV2-8.4-14/EC
C19 100nF
R20 75R
C18 100nF
SPDIF4+ SPDIF4-
T1 HR610675(Hanrun)
R19 2K7
C17 DNE
SRC_AESOUT
R23 47R
U4C 74LCX125MTC
GPO8
R26 47R
U4D 74LCX125MTC
GPO4
R1 47R
+5V
L1 22uH
C4 47uF/25V
C3 100nF
OPT2 in
U1
JSR1162-002
U5C 74LCX125MTC
GPO7
L2 22uH
C7 47uF/25V
C6 100nF
OPT1 in
U2
GPO2
U5B 74LCX125MTC
U5D 74LCX125MTC
GPO3
R2 47R
SUB Trig_1 OUT
J3 CKX-3.5-12A
C112 100nF
PTC1 FSMD010-1206
C113 100nF
R46 47K
D1 LL4148
Q3 SS8550
R60 1K
R61 10K
R71 10K
Q4 BSS123
SUB Trig_2 OUT
J7 CKX-3.5-12A
C114 100nF
A

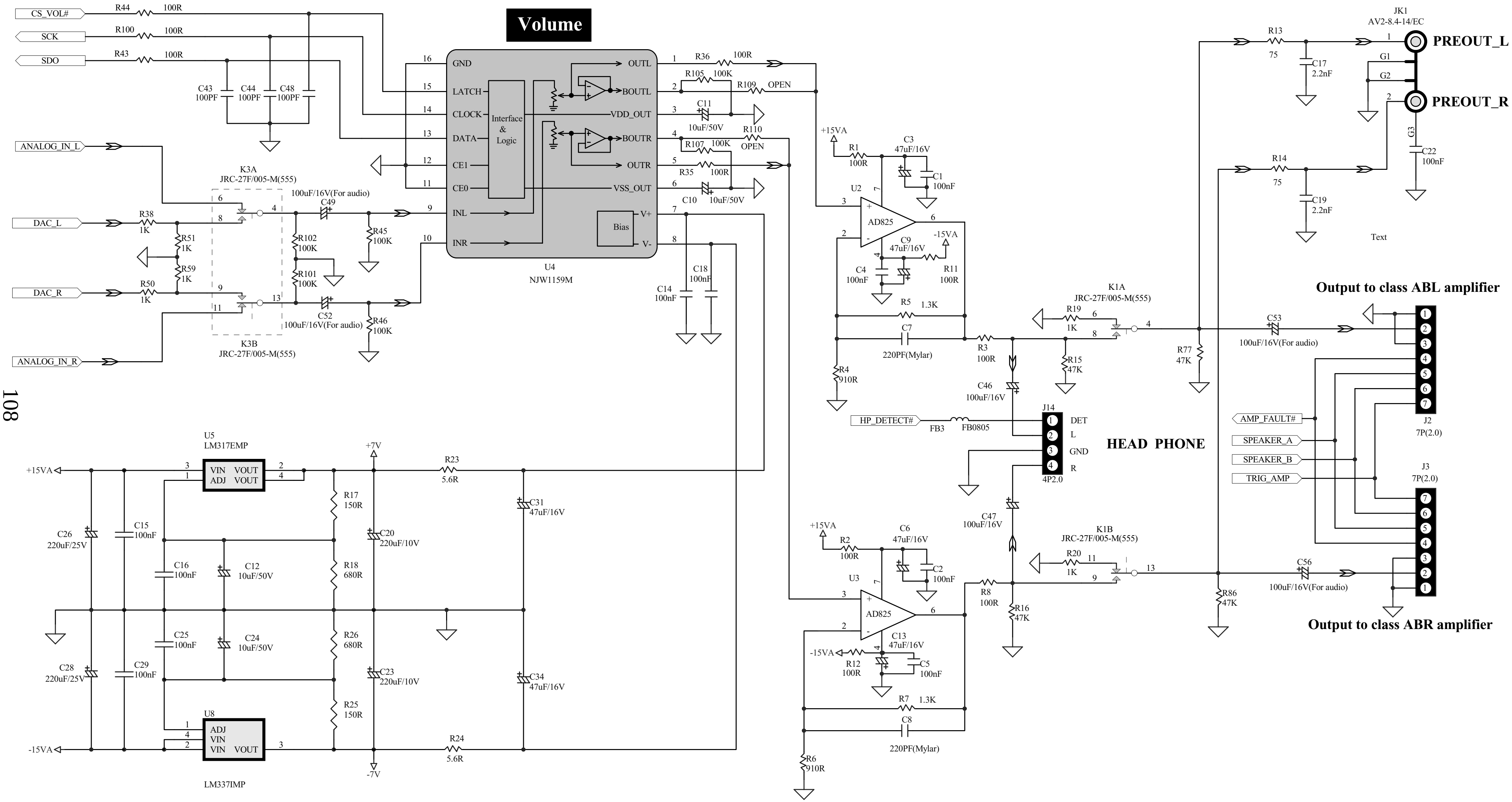

U12
XWM8740EDS
RST_SUB#
WM_LRCLK
WM_BITCLK
WM_SDATA
CLK_24_MHZ_4
MUTE_LISTEN#
SDO
SCK
CS_WM8740#
RST
LRCLK
BITCLK
SDATA
MCLK
MODE8X
MUTE
DIFFHW
CSBIWO
MISO/DM0
SCK/DM1
CS/I2S
MODE
DVDD
AVDD
AVDDL
AVDDR
DGND
AGND
AGNDL
AGNDR
VoutL+
VoutL-
VmidL
ZERO
VoutR+
VoutR-
VmidR
+3.3V
+5VA
FB2
FB0805
R37
10R
C58
47uF/25V
C59
100nF
C49
100nF
C57
100nF
C108
47uF/25V
C56
100nF
C48
47uF/25V
C50
47uF/25V
C41
100nF
G = 0.25 by software
U6
74HC4052D
U7
74HC4052D
1Y0
1Y1
1Y2
1Y3
2Y0
2Y1
2Y2
2Y3
VCC
VEE
GND
1Z
2Z
SO
S1
FB6
FB7
C43
100nF
C42
100nF
SUB_SEL
+15VA
-15VA
R12
100R
C64
47uF/16V
C29
100nF
U3A
NJM2068M
U3B
NJM2068M
C27
47uF/25V
R30
3K
R31
47K
C25
2A332J
C13
47uF/25V
R15
3K
C28
100nF
C107
47uF/16V
R27
100R
R16
47K
C14
2A332J
C119
47uF/25V
R10
470R
Subwoofer OUT L
Q1
DTC343TK
4.7K
SUB_MUTE_OUT
C10
330pF
G = 4
C30
47uF/25V
R33
3K
R32
47K
C26
2A332J
C16
47uF/25V
R18
3K
R17
47K
C15
2A332J
C120
47uF/25V
R11
470R
Subwoofer OUT R
Q2
DTC343TK
C11
330pF
J1B
SUB out
G2
AV4-8.4-13/EC
C2
100nF
G3
R3
24K
C9
47uF/25V
Subwoofer IN L
SUB in
G1
R4
24K
C12
47uF/25V
Subwoofer IN R
J1A
AV4-8.4-13/EC

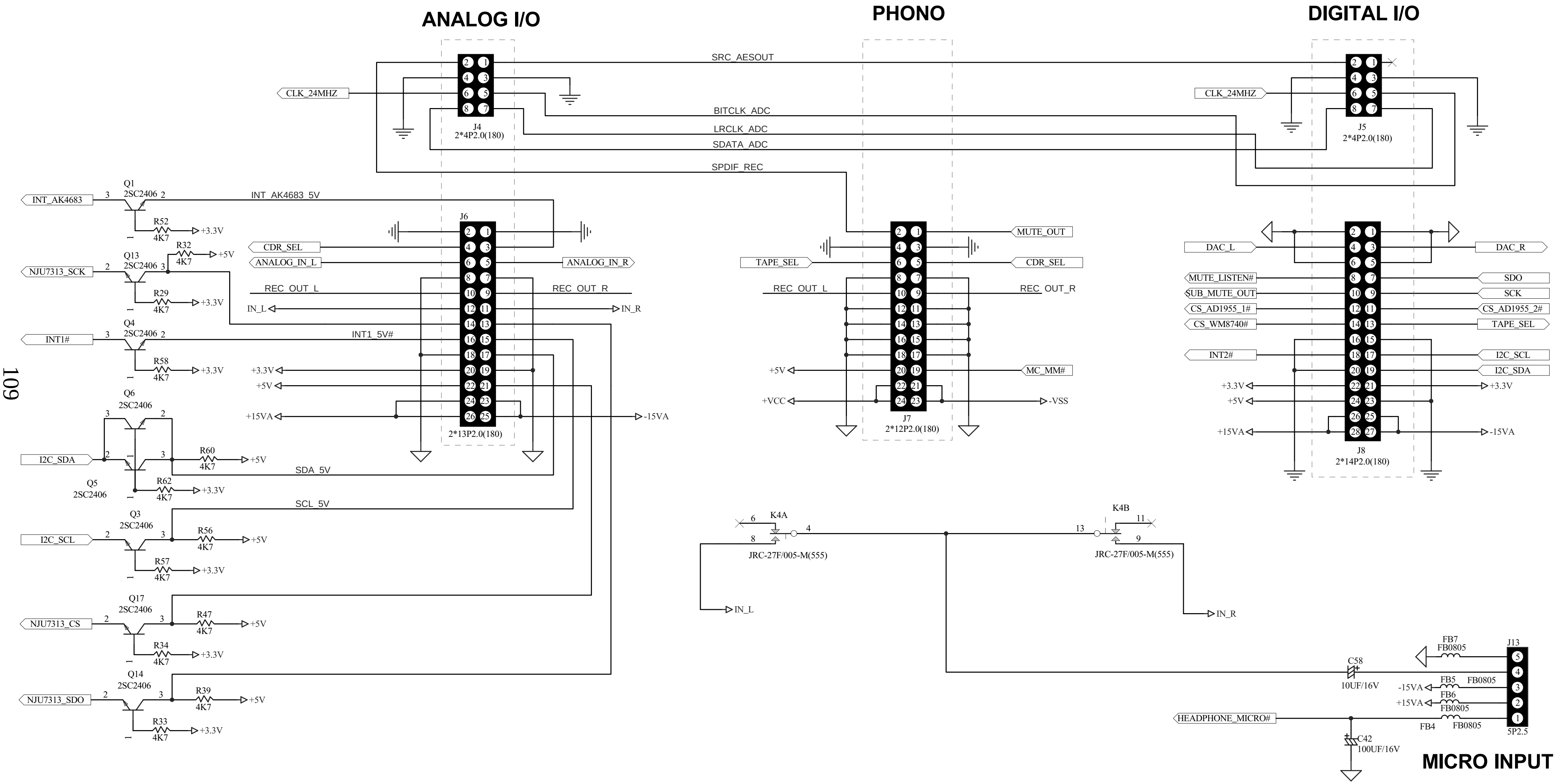


Phones board

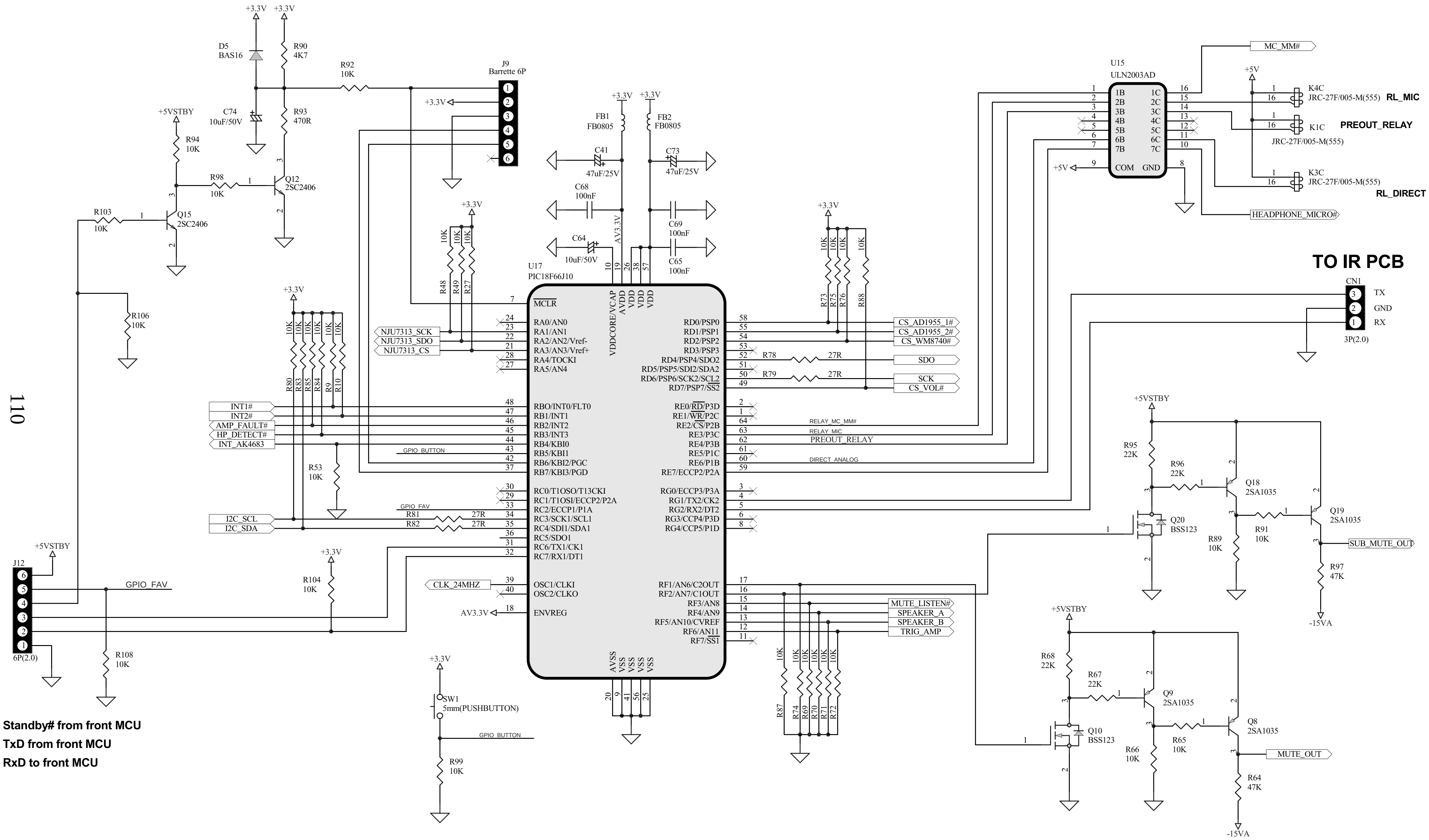

230V
0V
15V
45V
45V
15V
JP5
Faston 6.3
JP8
Faston 6.3
JP4
Faston 6.3
JP6
Faston 6.3
JP2
Faston 6.3
JP3
Faston 6.3
60VAC
diodes mounted on heatsink
45VAC
45VAC
60VAC
D5
MUR2020
D4
MUR2020
D2
MUR2020
D1
MUR2020
C15
10nF/250V
C14
10nF/250V
C8
10nF/250V
C5
10nF/250V
C13
6800uF/80V
C12
6800uF/80V
C4
6800uF/80V
C3
6800uF/80V
+60V
-60V
R16
10K 3W
R4
10K 3W
R26
0.22R(RF) 2W
R27
0.22R(RF) 2W
D3
GBU8D
+80V
-80V
C11
1000uF/100V
C7
1000uF/100V
R15
22K 3W
R3
22K 3W
R96
2K4 2W
R97
2K4 2W
Q39
MJD243
Q20
MJD253
R89
10K
R25
10K
C34
1uF
C19
1uF
D26
D6
ZMM16ST(16V)
C32
1uF
C20
1uF
+16V
-16V
R82
10K
R30
10K
+/- 16VDC rails current:
1. 0.2mA for TL061
2. 4mA for OPA2134
3. 4mA for input stage
JP7
JP1
J1
7P * 2mm
R57
22K
R58
1K
C28
330pF
INPUT
FAULT#
MUTE#
+60V
C35
47nF
R94
10K
Q43
2SA1255
R92
33K
R93
33K
R91
33K
U2
PC817A
Q42
2SC3138
R81
390R
SENSE+
C33
2.2uF
D24
DL4148
R22 6K2 1/2W
D23
DL4148
SENSE-
RL3C
HF-115F-048-1ZS3B
D27
BAS20
R24
2K2 1W
R90
1K
Q44
2SC3138
R95
22K
RL4C
HF-115F-048-1ZS3B
D8
BAS20
R1
2K2 1W
R28
1K
Q21
2SC3138
R29
22K
R10
5R6 1W
C36
100nF
EGND
Q41
2SC3138
R83
4K3
R80
390R
R77
68K
R79
10K
Q40
2SC3138
C37
47uF
C31
47uF
R78
10K
D19
DL4148
D16
DL4148
U4
TL061CD
R59
22K
R62
10K
R60
10K
R61
10K
RT1
CWF51-104J-3951(100K)
100K
L1
2.2uH
R12
1R 5W
OUTPUT
R11
5R 5W
C10
47nF/100V
C9
47nF/100V
HF-115F-048-1ZS3B
RL3A
SPEAKER A
JP9
RL3B
HF-115F-048-1ZS3B
RL4A
HF-115F-048-1ZS3B
SPEAKER B
JP10
RL4B
HF-115F-048-1ZS3B

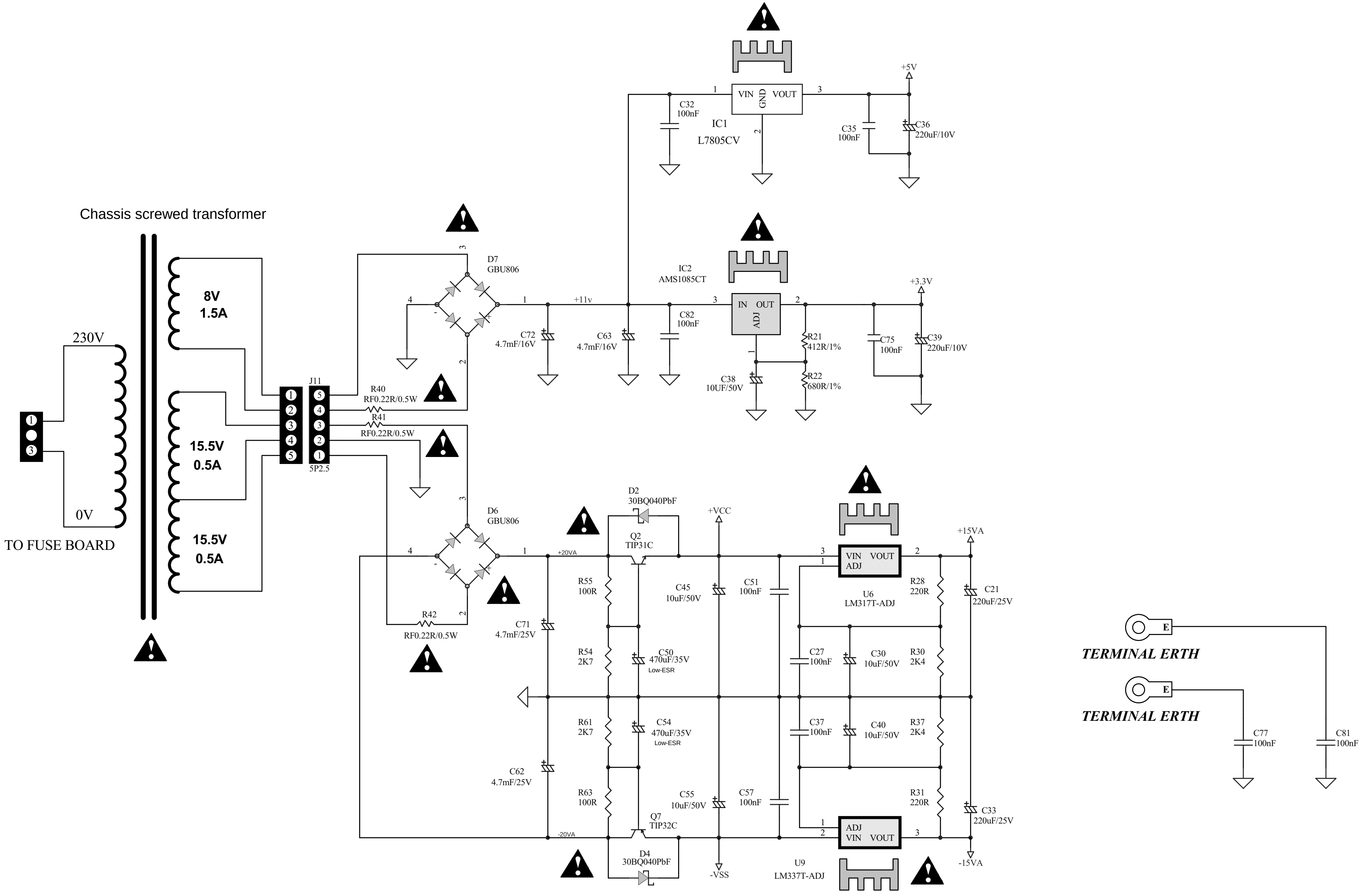

+80V
-80V
+60V
-60V
+16V
-16V
MUTE#
INPUT
OUTPUT
SENSE+
SENSE-
U1 PC817A
R42 1K
2 x 2.2mA
38mV
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
Q22 2SA1312
Q23 2SA1312
Q34 2SC3324
Q35 2SC3324
Q36 2SC3324
Q33 2SC3324
Q31 2SC3324
Q30 2SC3324
Q28 2SA1312
Q26 2SA1312
Q29 2SA1312
Q27 2SA1312
Q37 2SC3324
Q38 MJD253
Q11 2SA1837
Q9 2SC4793
Q25 MJD243
Q24 2SA1312
Q32 BCP56-16
Q10 2SC4935
Q8 2SA1869
Q18 2SC4793
Q17 MJE15032
Q7 MJE15033
Q6 2SA1837
Q13 MJL3281A
Q12 MJL3281A
Q14 NJL3281D
Q15 MJL3281A
Q16 MJL3281A
Q2 MJL1302A
Q1 MJL1302A
Q3 NJL1302D
Q4 MJL1302A
Q5 MJL1302A
R53 3224W-200R(BOURNS)
R13 22K 3W
R14 30K 3W
R73 12K 1/4W 1%
R48 12K 1/4W 1%
R76 150R 1/4W 1%
R43 150R 1/4W 1%
R23 150R 3W
R2 150R 3W
R55 10K 1/4W 1%
R56 270R
R54 6K2
R31 1M
R32 1M
C26 47nF(Mylar)10% Mylar Cap
C70 47nF(Mylar)10% Mylar Cap
C25 270pF(NPO)5%
C27 3.9pF(NPO)5%
C18 220uF/100V
C2 220uF/100V
C17 47nF/100V
C16 47nF/100V
C1 47nF/100V
C6 47nF/100V
U3A OPA2134UA
U3B OPA2134UA
2SA1255 & 2SC3138: SOT-23
2SA1312 & 2SC3324: SOT-23
2SC4935 & 2SA1869: TO-220
2SC4793 & 2SA1837: TO-220
MJD243 & MJD253: DPACK
MJE15032 & MJE15033: TO-220
NJL3281D & NJL1302D: TO-264
MJL3281A & MJL1302A: TO-264

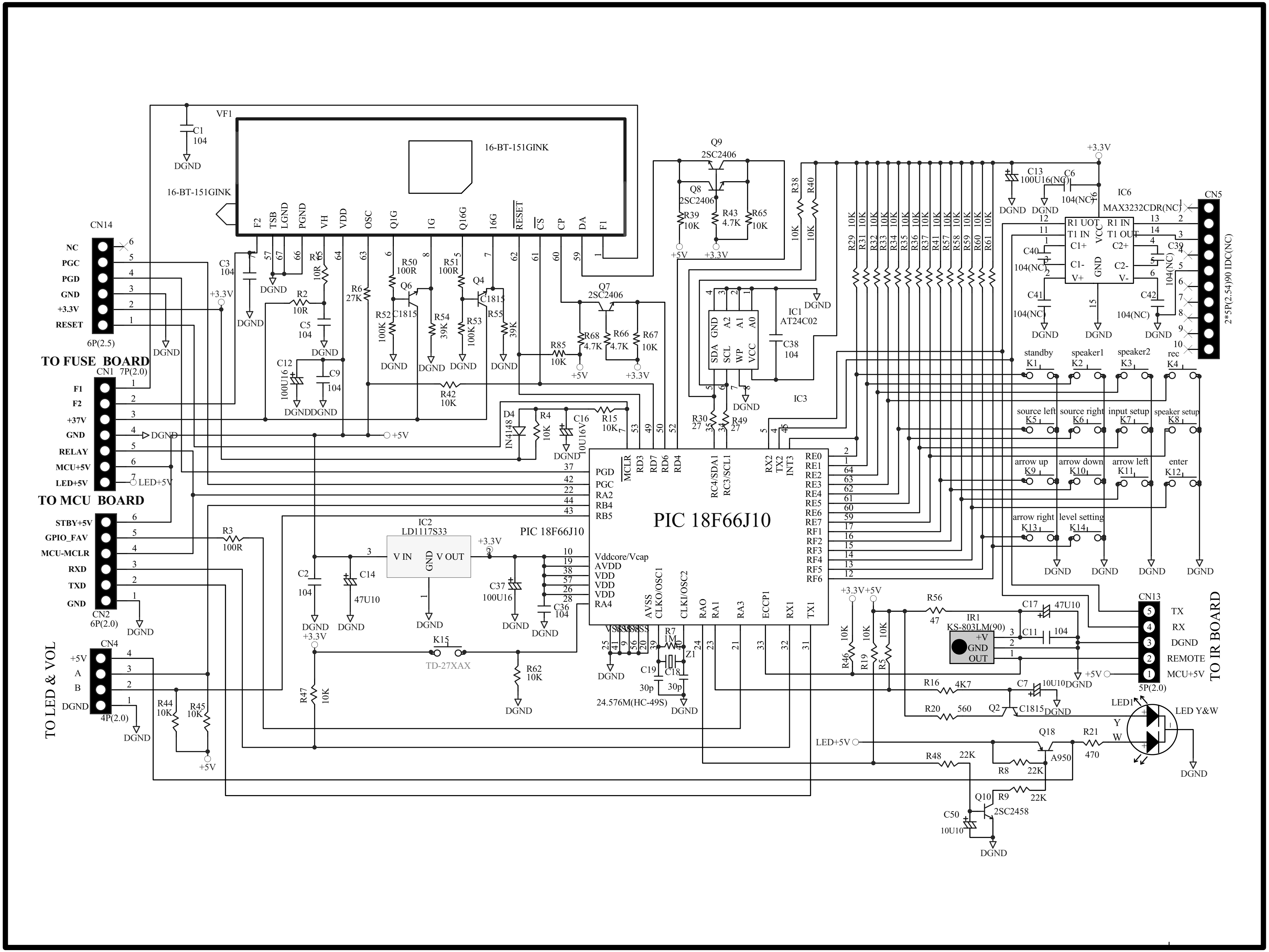

Volume
CS_VOL#
SCK
SDO
R44 100R
R100 100R
R43 100R
C43 100PF
C44 100PF
C48 100PF
ANALOG_IN_L
DAC_L
DAC_R
ANALOG_IN_R
K3A JRC-27F/005-M(555)
K3B JRC-27F/005-M(555)
R38 1K
R51 1K
R59 1K
R50 1K
C49 100uF/16V(For audio)
C52 100uF/16V(For audio)
R102 100K
R101 100K
R45 100K
R46 100K
GND
LATCH
CLOCK
DATA
CE1
CE0
INL
INR
Interface & Logic
Bias
OUTL
BOUTL
VDD_OUT
BOUTR
OUTR
VSS_OUT
V+
V-
U4 NJW1159M
R36 100R
R105 100K
R109 OPEN
C11 10uF/50V
R107 100K
R110 OPEN
R35 100R
C10 10uF/50V
C14 100nF
C18 100nF
+15VA
-15VA
R1 100R
C3 47uF/16V
C1 100nF
U2
AD825
C9 47uF/16V
C4 100nF
R11 100R
R5 1.3K
C7 220PF(Mylar)
R4 910R
R3 100R
R15 47K
C46 100uF/16V
K1A JRC-27F/005-M(555)
R19 1K
R77 47K
C53 100uF/16V(For audio)
JK1 AV2-8.4-14/EC
R13 75
C17 2.2nF
G1
G2
G3
PREOUT_L
PREOUT_R
R14 75
C19 2.2nF
C22 100nF
Text
Output to class ABL amplifier
J2 7P(2.0)
AMP_FAULT#
SPEAKER_A
SPEAKER_B
TRIG_AMP
J3 7P(2.0)
HP_DETECT#
FB3 FB0805
J14 4P2.0
DET
L
GND
R
HEAD PHONE
C47 100uF/16V
K1B JRC-27F/005-M(555)
R20 1K
C56 100uF/16V(For audio)
R86 47K
Output to class ABR amplifier
R2 100R
C6 47uF/16V
C2 100nF
U3
AD825
C13 47uF/16V
R12 100R
C5 100nF
R7 1.3K
C8 220PF(Mylar)
R6 910R
R8 100R
R16 47K
U5 LM317EMP
VIN VOUT
ADJ VOUT
+7V
-7V
R23 5.6R
R24 5.6R
C26 220uF/25V
C15 100nF
C16 100nF
C12 10uF/50V
R17 150R
R18 680R
C20 220uF/10V
C31 47uF/16V
C25 100nF
C24 10uF/50V
R26 680R
C23 220uF/10V
C34 47uF/16V
C28 220uF/25V
C29 100nF
R25 150R
U8
ADJ
VIN
VIN VOUT
LM337IMP



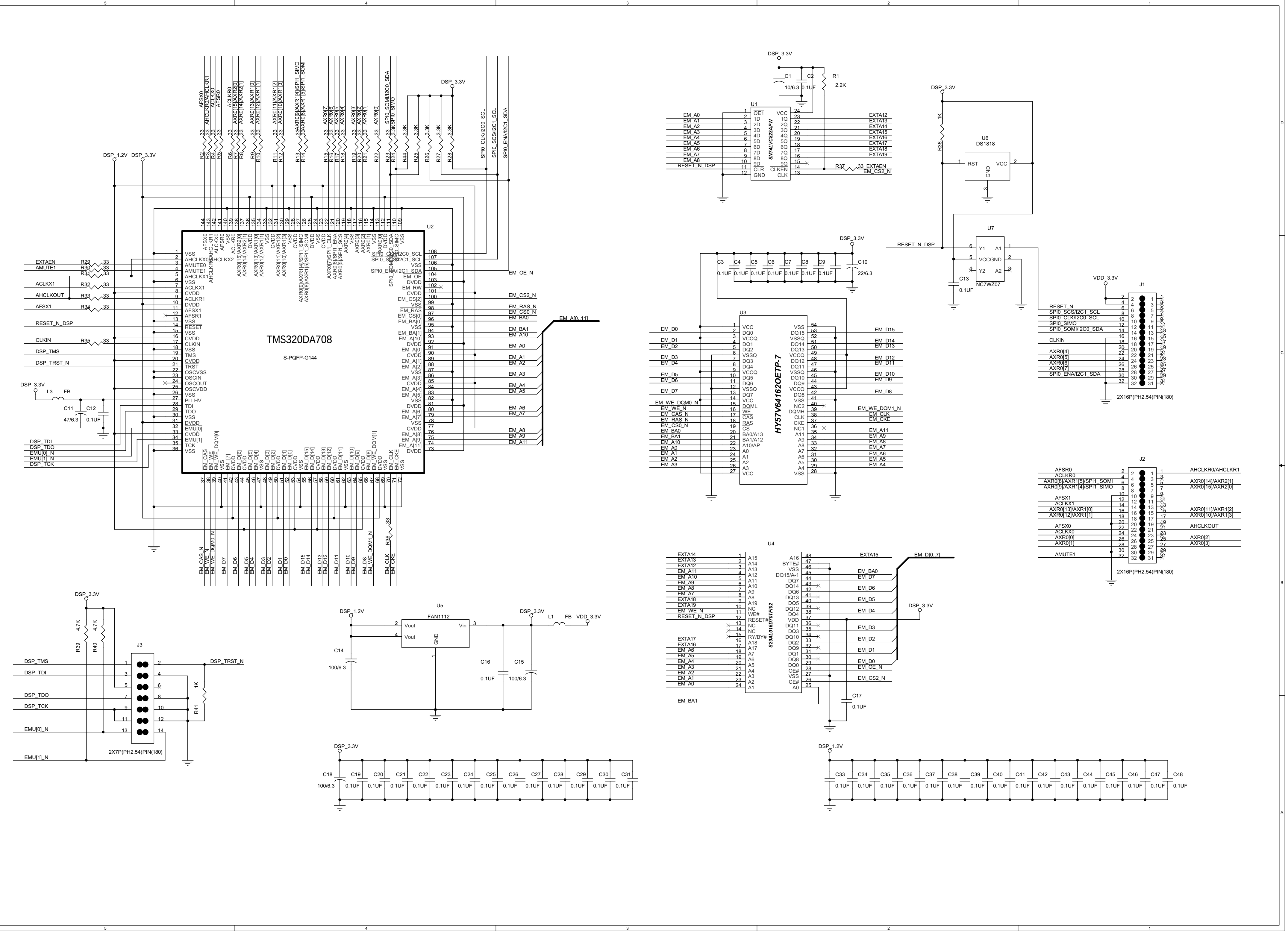
ANALOG I/O
PHONO
DIGITAL I/O
MICRO INPUT
J4
2*4P2.0(180)
J5
2*4P2.0(180)
J6
2*13P2.0(180)
J7
2*12P2.0(180)
J8
2*14P2.0(180)
J13
5P2.5
SRC_AESOUT
BITCLK_ADC
LRCLK_ADC
SDATA_ADC
SPDIF_REC
CLK_24MHZ
INT_AK4683
INT_AK4683_5V
INT1#
INT1_5V#
NJU7313_SCK
NJU7313_CS
NJU7313_SDO
I2C_SDA
I2C_SCL
SDA_5V
SCL_5V
CDR_SEL
ANALOG_IN_L
ANALOG_IN_R
REC_OUT_L
REC_OUT_R
IN_L
IN_R
MUTE_OUT
TAPE_SEL
MC_MM#
DAC_L
DAC_R
MUTE_LISTEN#
SUB_MUTE_OUT
CS_AD1955_1#
CS_AD1955_2#
CS_WM8740#
INT2#
SDO
SCK
HEADPHONE_MICRO#
2SC2406
4K7
+3.3V
+5V
+15VA
-15VA
+VCC
-VSS
K4A
K4B
JRC-27F/005-M(555)
C58
10UF/16V
C42
100UF/16V
FB4
FB5
FB6
FB7
FB0805


TO IR PCB
U17
PIC18F66J10
U15
ULN2003AD
J9
Barrette 6P
J12
6P(2.0)
CN1
3P(2.0)
TX
GND
RX
RL_MIC
PREOUT_RELAY
RL_DIRECT
K4C
K1C
K3C
JRC-27F/005-M(555)
MC_MM#
HEADPHONE_MICRO#
NJU7313_SCK
NJU7313_SDO
NJU7313_CS
INT1#
INT2#
AMP_FAULT#
HP_DETECT#
INT_AK4683
I2C_SCL
I2C_SDA
CLK_24MHZ
CS_AD1955_1#
CS_AD1955_2#
CS_WM8740#
SDO
SCK
CS_VOL#
MUTE_LISTEN#
SPEAKER_A
SPEAKER_B
TRIG_AMP
SUB_MUTE_OUT
MUTE_OUT
GPIO_FAV
GPIO_BUTTON
SW1
5mm(PUSHBUTTON)
Standby# from front MCU
TxD from front MCU
RxD to front MCU

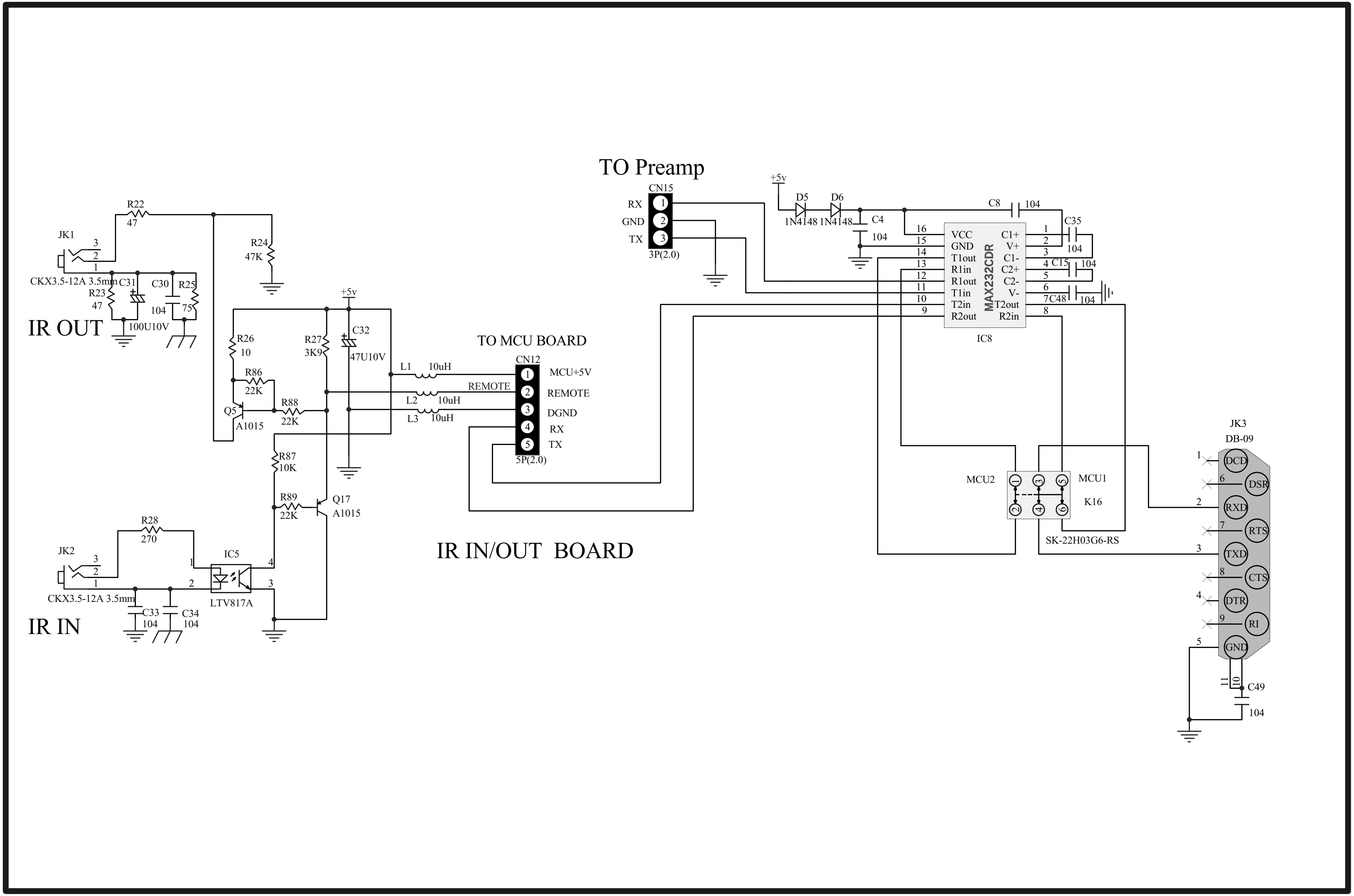

Chassis screwed transformer
230V
0V
TO FUSE BOARD
8V
1.5A
15.5V
0.5A
15.5V
0.5A
J11
5P2.5
R40
RF0.22R/0.5W
R41
RF0.22R/0.5W
R42
RF0.22R/0.5W
D7
GBU806
D6
GBU806
+11v
C72
4.7mF/16V
C63
4.7mF/16V
C32
100nF
IC1
L7805CV
VIN
GND
VOUT
+5V
C35
100nF
C36
220uF/10V
IC2
AMS1085CT
IN
OUT
ADJ
C82
100nF
R21
412R/1%
R22
680R/1%
C38
10UF/50V
+3.3V
C75
100nF
C39
220uF/10V
D2
30BQ040PbF
Q2
TIP31C
+20VA
+VCC
R55
100R
C71
4.7mF/25V
R54
2K7
C50
470uF/35V
Low-ESR
C45
10uF/50V
C51
100nF
U6
LM317T-ADJ
R28
220R
+15VA
C21
220uF/25V
C27
100nF
C30
10uF/50V
R30
2K4
R61
2K7
C54
470uF/35V
Low-ESR
C37
100nF
C40
10uF/50V
R37
2K4
C62
4.7mF/25V
R63
100R
C55
10uF/50V
C57
100nF
R31
220R
C33
220uF/25V
Q7
TIP32C
-20VA
D4
30BQ040PbF
-VSS
U9
LM337T-ADJ
-15VA
TERMINAL ERTH
TERMINAL ERTH
C77
100nF
C81
100nF

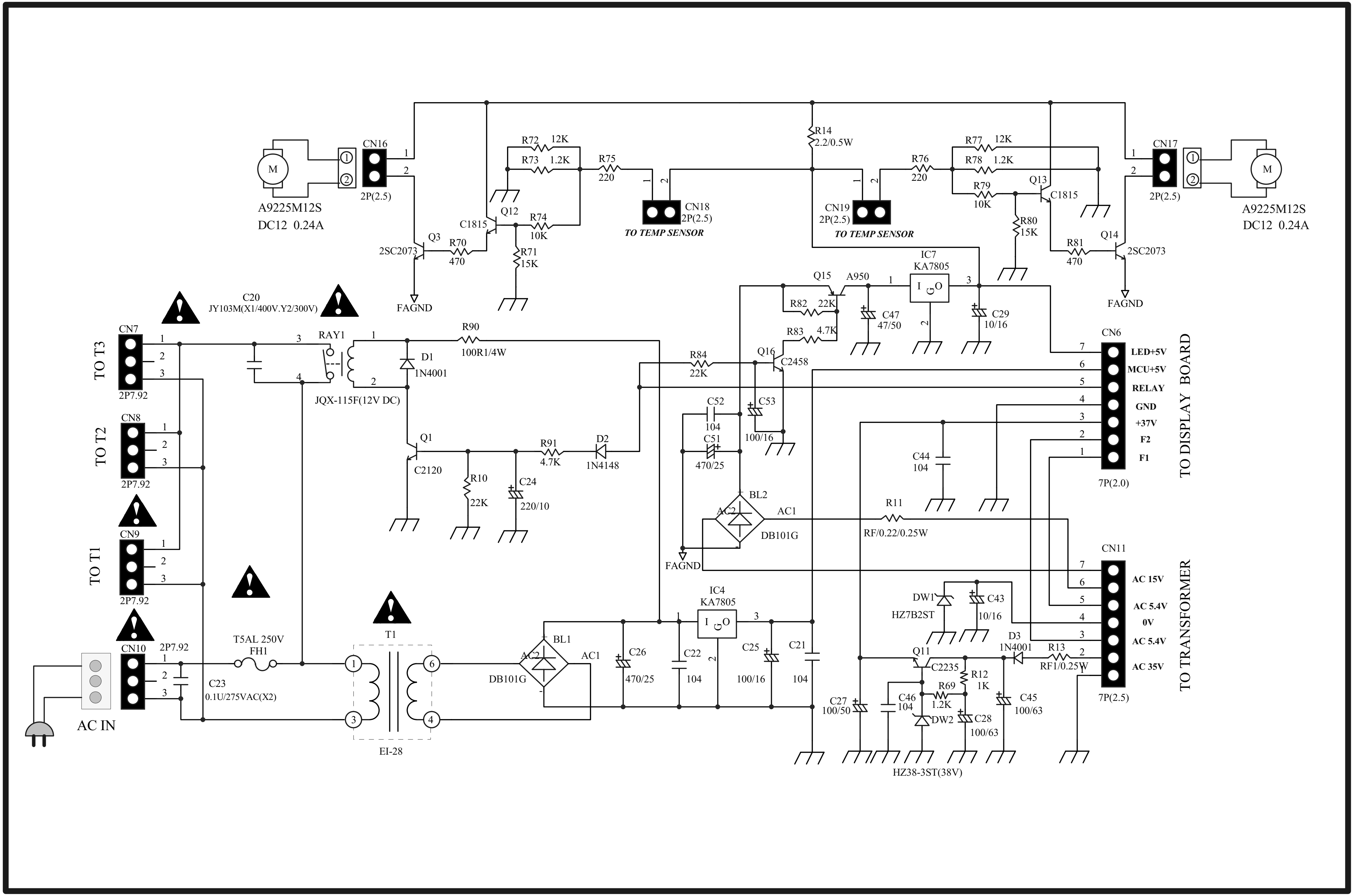


VF1
16-BT-151GINK
F2 TSB LGND PGND VH VDD OSC Q1G 1G Q16G 16G RESET CS CP DA F1
CN14
NC
PGC
PGD
GND
+3.3V
RESET
6P(2.5)
TO FUSE BOARD
CN1 7P(2.0)
F1
F2
+37V
GND
RELAY
MCU+5V
LED+5V
TO MCU BOARD
STBY+5V
GPIO_FAV
MCU-MCLR
RXD
TXD
GND
CN2 6P(2.0)
CN4
+5V
A
B
DGND
4P(2.0)
TO LED & VOL
IC2 LD1117S33
V IN
GND
V OUT
PIC 18F66J10
PGD PGC RA2 RB4 RB5
Vddcore/Vcap AVDD VDD VDD VDD RA4
MCLR RD3 RD7 RD6 RD4
RC4/SDA1 RC3/SCL1
RX2 TX2 INT3
RE0 RE1 RE2 RE3 RE4 RE5 RE6 RE7 RF1 RF2 RF3 RF4 RF5 RF6
AVSS CLKO/OSC1 CLKI/OSC2 RAO RA1 RA3 ECCP1 RX1 TX1
24.576M(HC-49S)
K15 TD-27XAX
IC1 AT24C02
SDA SCL WP VCC GND A2 A1 A0
Q9 2SC2406
Q8 2SC2406
Q7 2SC2406
IC6 MAX3232CDR(NC)
R1 UOT T1 IN C1+ C1- V+ R1 IN T1 OUT C2+ C2- V- VCC GND
CN5
2*5P(2.54)90 IDC(NC)
standby speaker1 speaker2 rec
source left source right input setup speaker setup
arrow up arrow down arrow left enter
arrow right level setting
CN13
TX
RX
DGND
REMOTE
MCU+5V
5P(2.0)
TO IR BOARD
IR1 KS-803LM(90)
+V GND OUT
Q2 C1815
Q18 A950
Q10 2SC2458
LED1 LED Y&W
Y
W
LED+5V
DGND
+3.3V
+5V

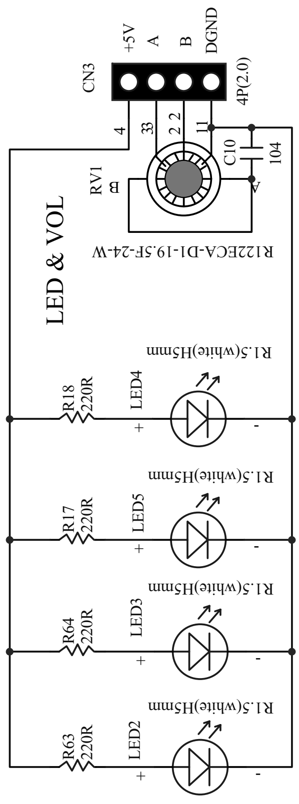


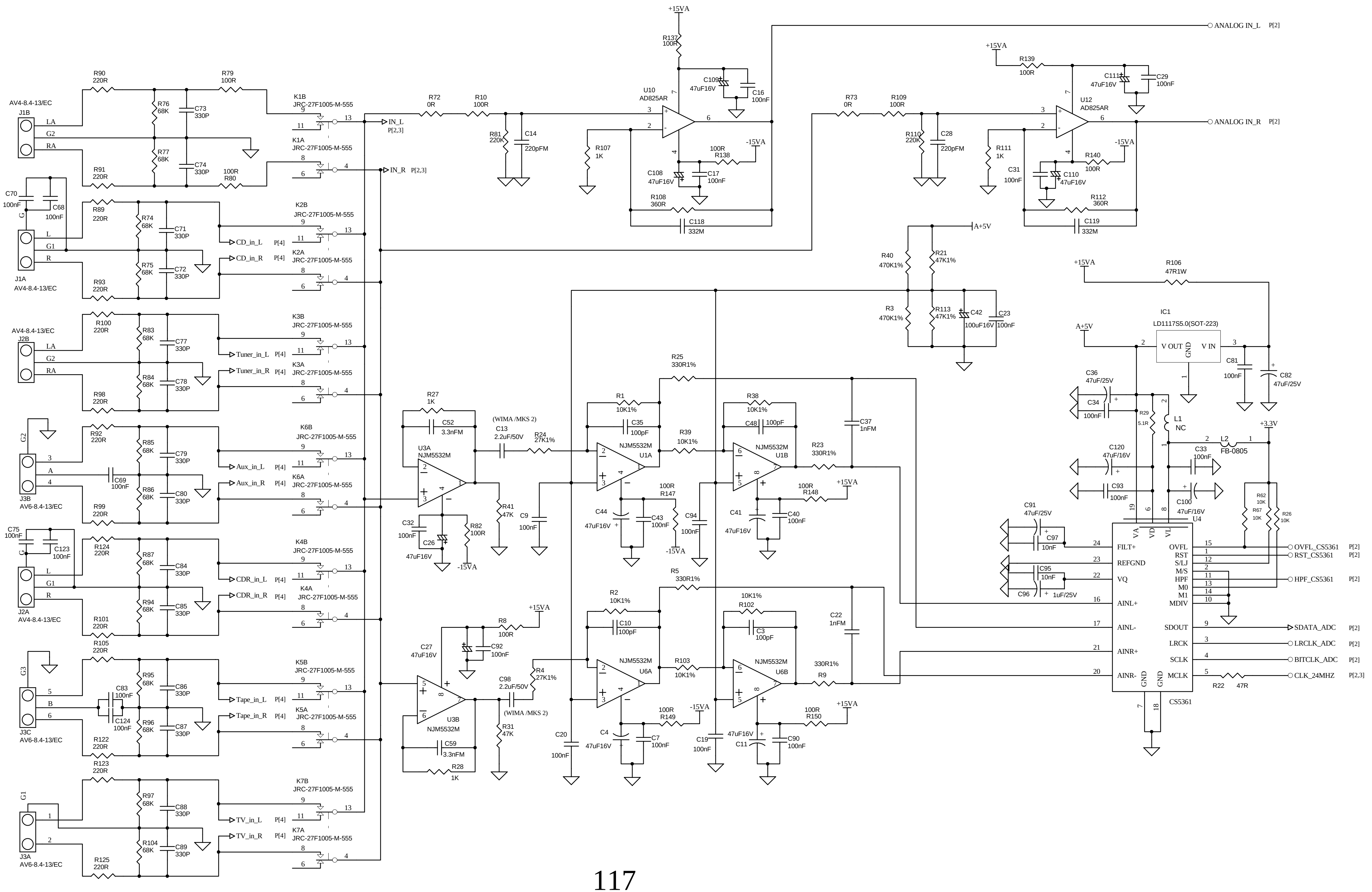
TMS320DA708
S-PQFP-G144
U2
SN74LVC823APW
U1
HY57V64162OETP-7
U3
S29AL016D70TFI02
U4
FAN1112
U5
DS1818
U6
NC7WZ07
U7
J1
2X16P(PH2.54)PIN(180)
J2
2X16P(PH2.54)PIN(180)
J3
2X7P(PH2.54)PIN(180)
DSP_3.3V
DSP_1.2V
VDD_3.3V
RESET_N_DSP
DSP_TMS
DSP_TDI
DSP_TDO
DSP_TCK
DSP_TRST_N
EMU[0]_N
EMU[1]_N
EM_A[0..11]
EM_D[0..7]

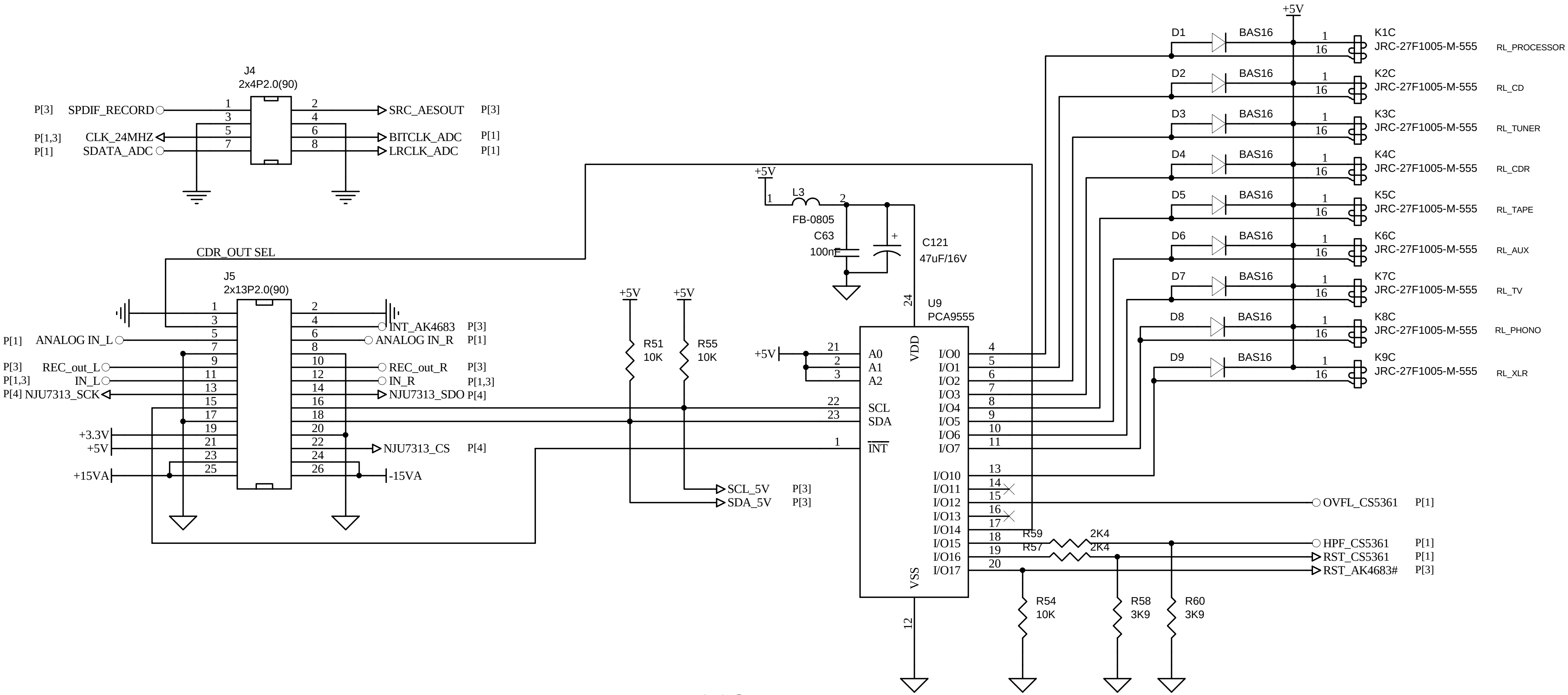

TO Preamp
CN15
RX
GND
TX
3P(2.0)
+5v
D5
D6
1N4148 1N4148
C4
104
C8
104
C35
104
C15
104
C48
104
VCC
GND
T1out
R1in
R1out
T1in
T2in
R2out
C1+
V+
C1-
C2+
C2-
V-
T2out
R2in
MAX232CDR
IC8
JK1
CKX3.5-12A 3.5mm
R22
47
R24
47K
R23
47
C31
100U10V
C30
104
R25
75
IR OUT
+5v
R26
10
R27
3K9
C32
47U10V
R86
22K
R88
22K
Q5
A1015
L1
10uH
L2
10uH
L3
10uH
REMOTE
TO MCU BOARD
CN12
MCU+5V
REMOTE
DGND
RX
TX
5P(2.0)
R87
10K
R89
22K
Q17
A1015
JK2
R28
270
IC5
LTV817A
CKX3.5-12A 3.5mm
C33
104
C34
104
IR IN
IR IN/OUT BOARD
MCU2
MCU1
K16
SK-22H03G6-RS
JK3
DB-09
DCD
DSR
RXD
RTS
TXD
CTS
DTR
RI
GND
C49
104



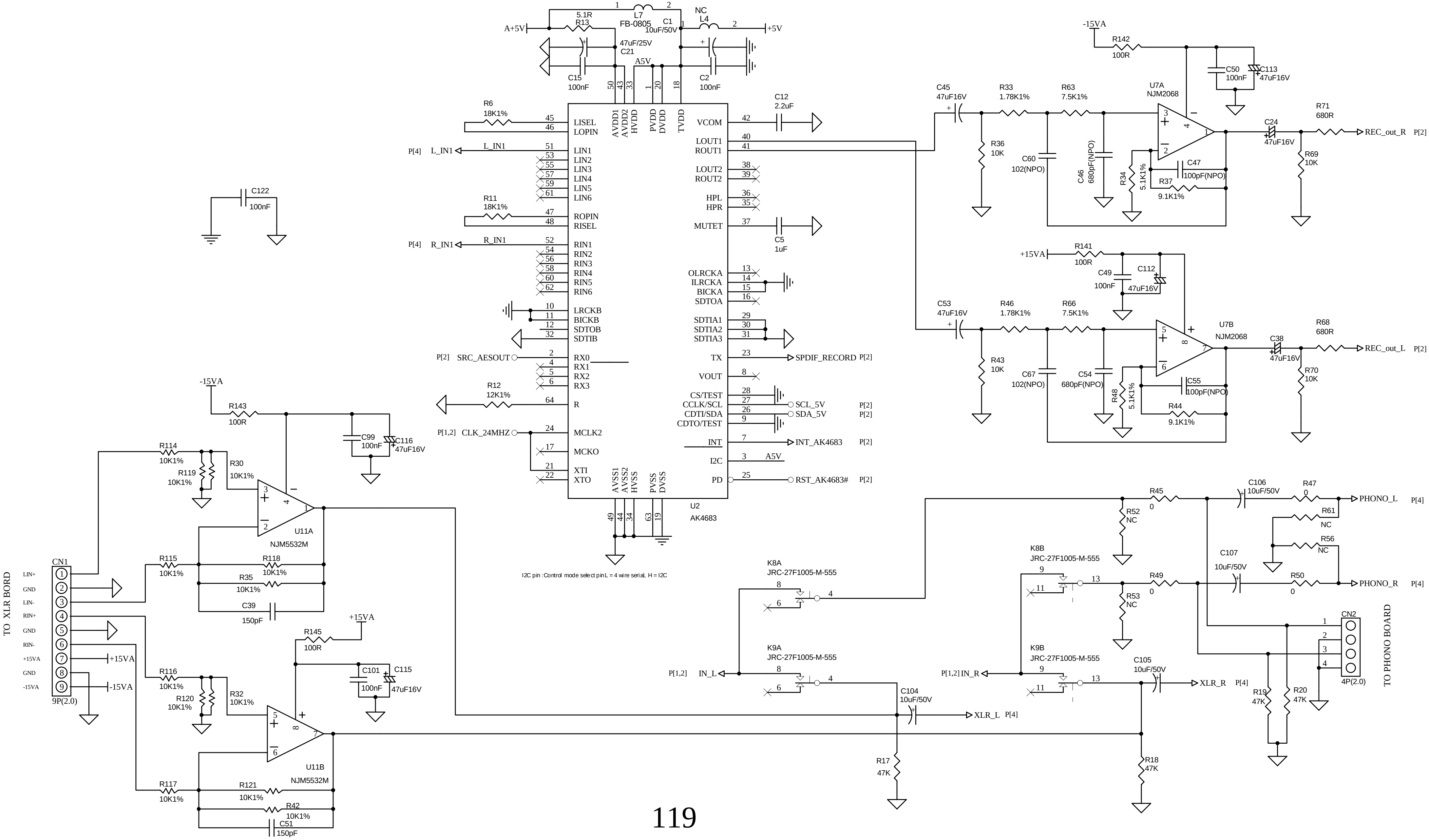
CN16
2P(2.5)
A9225M12S
DC12 0.24A
M
Q3
2SC2073
R70
470
FAGND
C1815
Q12
R72 12K
R73 1.2K
R74
10K
R71
15K
R75
220
CN18
2P(2.5)
TO TEMP SENSOR
R14
2.2/0.5W
CN19
2P(2.5)
TO TEMP SENSOR
R76
220
R77 12K
R78 1.2K
R79
10K
Q13
C1815
R80
15K
R81
470
Q14
2SC2073
FAGND
CN17
2P(2.5)
A9225M12S
DC12 0.24A
C20
JY103M(X1/400V.Y2/300V)
CN7
TO T3
2P7.92
CN8
TO T2
2P7.92
CN9
TO T1
2P7.92
RAY1
JQX-115F(12V DC)
D1
1N4001
R90
100R1/4W
Q1
C2120
R10
22K
C24
220/10
R91
4.7K
D2
1N4148
Q15
A950
R82 22K
R83 4.7K
IC7
KA7805
C47
47/50
C29
10/16
R84
22K
Q16
C2458
C52
104
C53
100/16
C51
470/25
BL2
AC2
AC1
DB101G
FAGND
R11
RF/0.22/0.25W
C44
104
CN6
LED+5V
MCU+5V
RELAY
GND
+37V
F2
F1
7P(2.0)
TO DISPLAY BOARD
CN11
AC 15V
AC 5.4V
0V
AC 5.4V
AC 35V
7P(2.5)
TO TRANSFORMER
CN10
2P7.92
AC IN
C23
0.1U/275VAC(X2)
T5AL 250V
FH1
T1
EI-28
BL1
DB101G
AC2
AC1
IC4
KA7805
C26
470/25
C22
104
C25
100/16
C21
104
DW1
HZ7B2ST
C43
10/16
Q11
C2235
R12
1K
R69
1.2K
D3
1N4001
R13
RF1/0.25W
C27
100/50
C46
104
DW2
C28
100/63
C45
100/63
HZ38-3ST(38V)

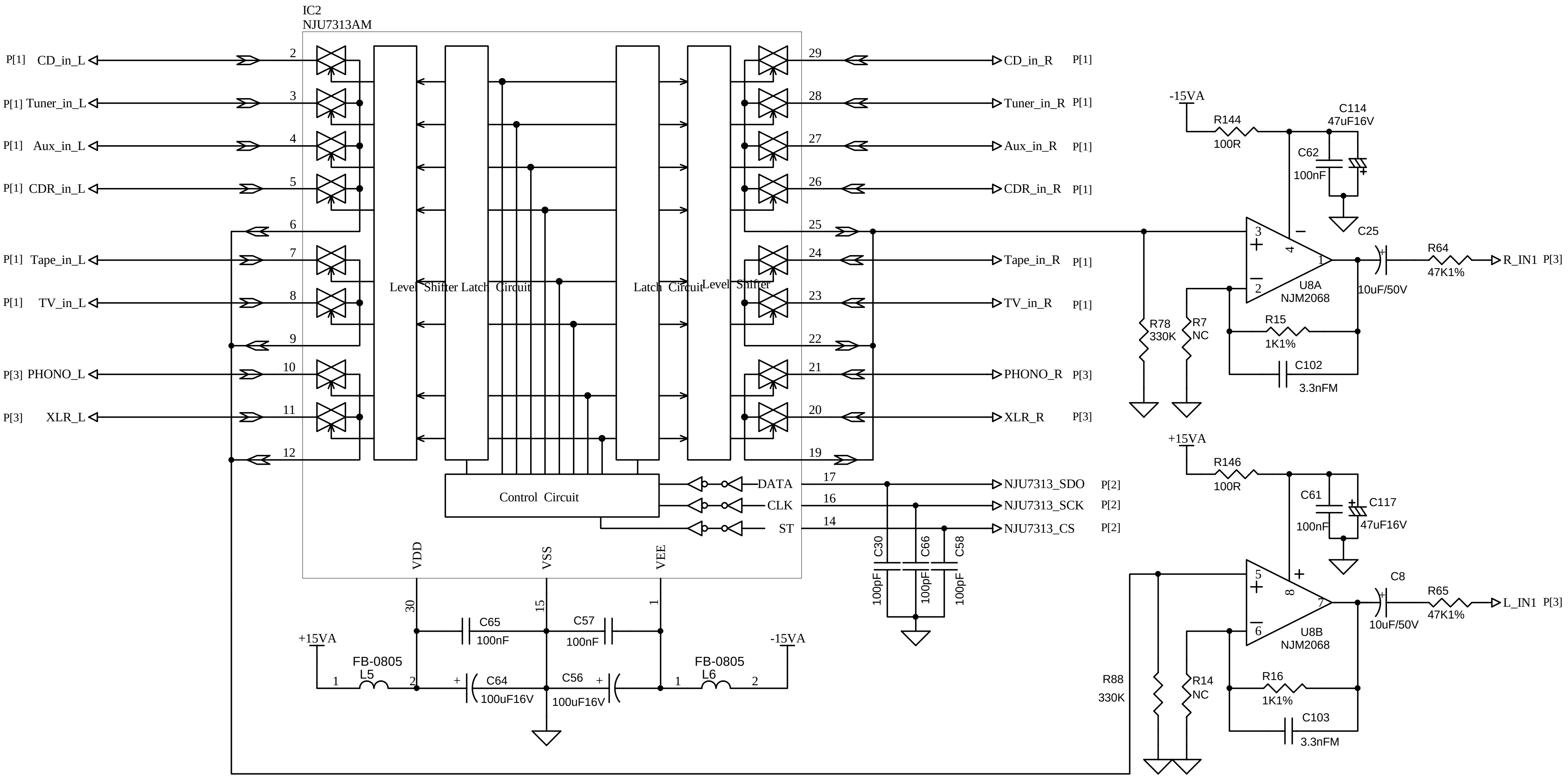

LED & VOL
CN3
+5V
A
B
DGND
4P(2.0)
RV1
R122ECA-D1-19.5F-24-W
C10
104
R18
220R
R17
220R
R64
220R
R63
220R
LED4
LED5
LED3
LED2
R1.5(white)H5mm
R1.5(white)H5mm
R1.5(white)H5mm
R1.5(white)H5mm

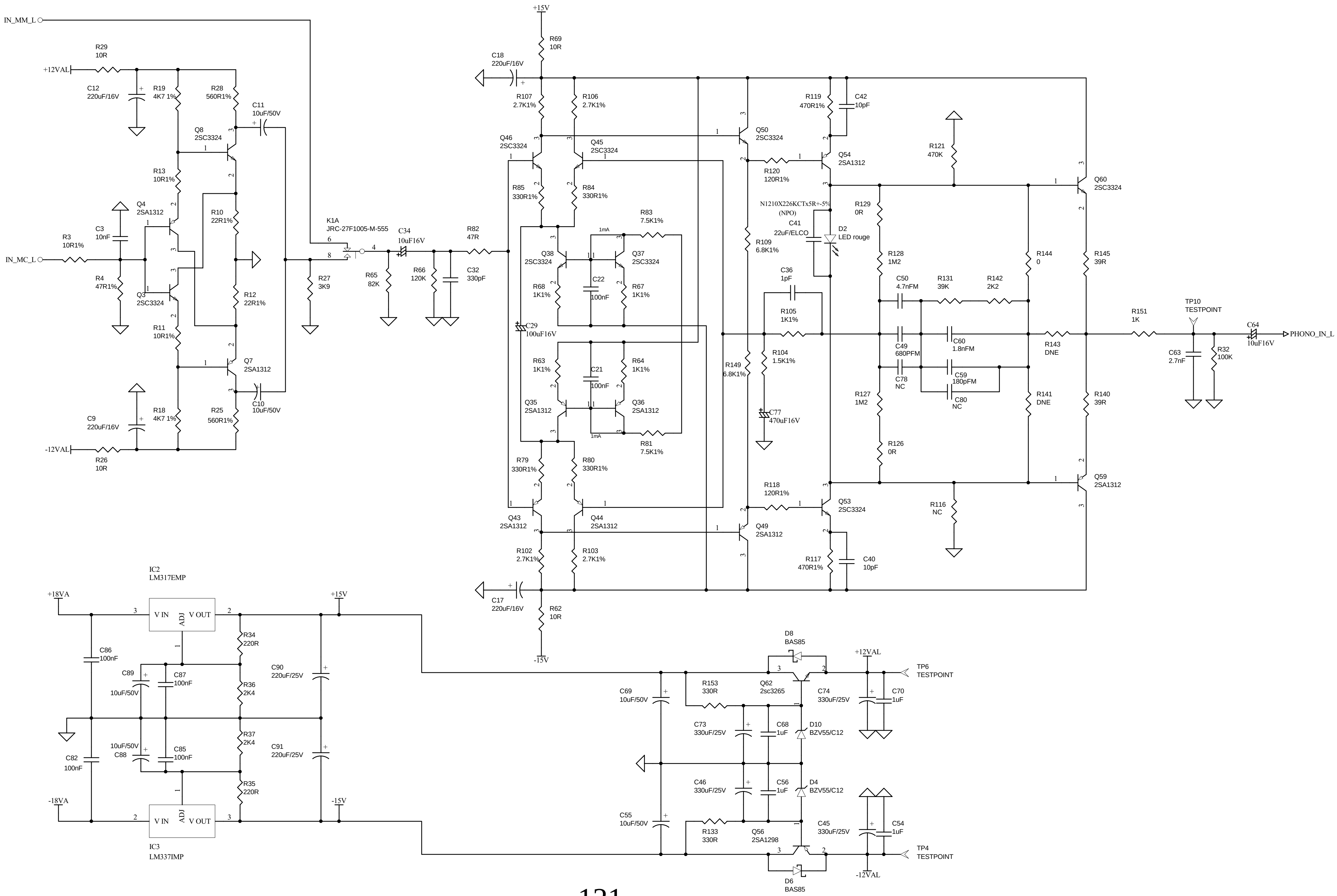


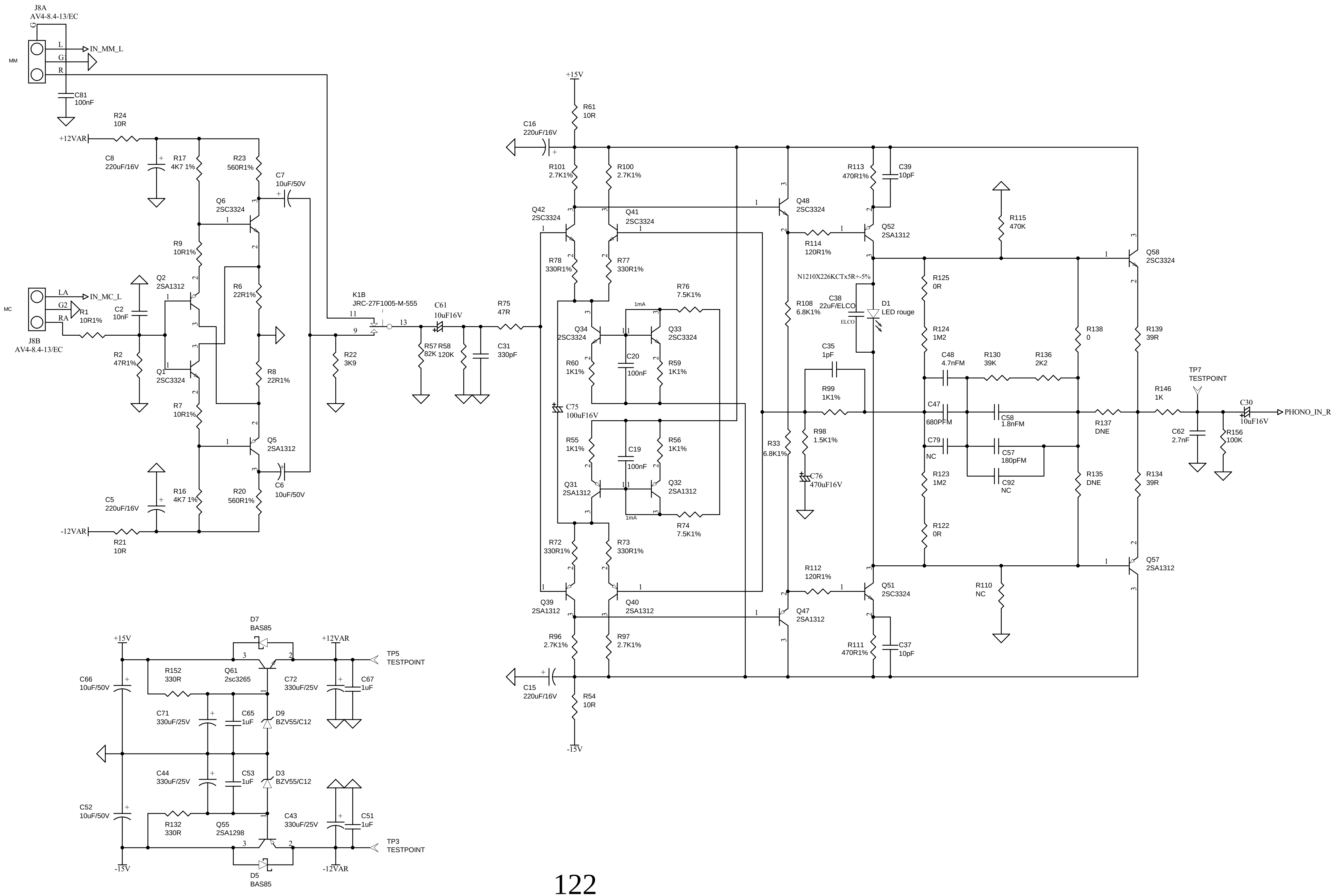


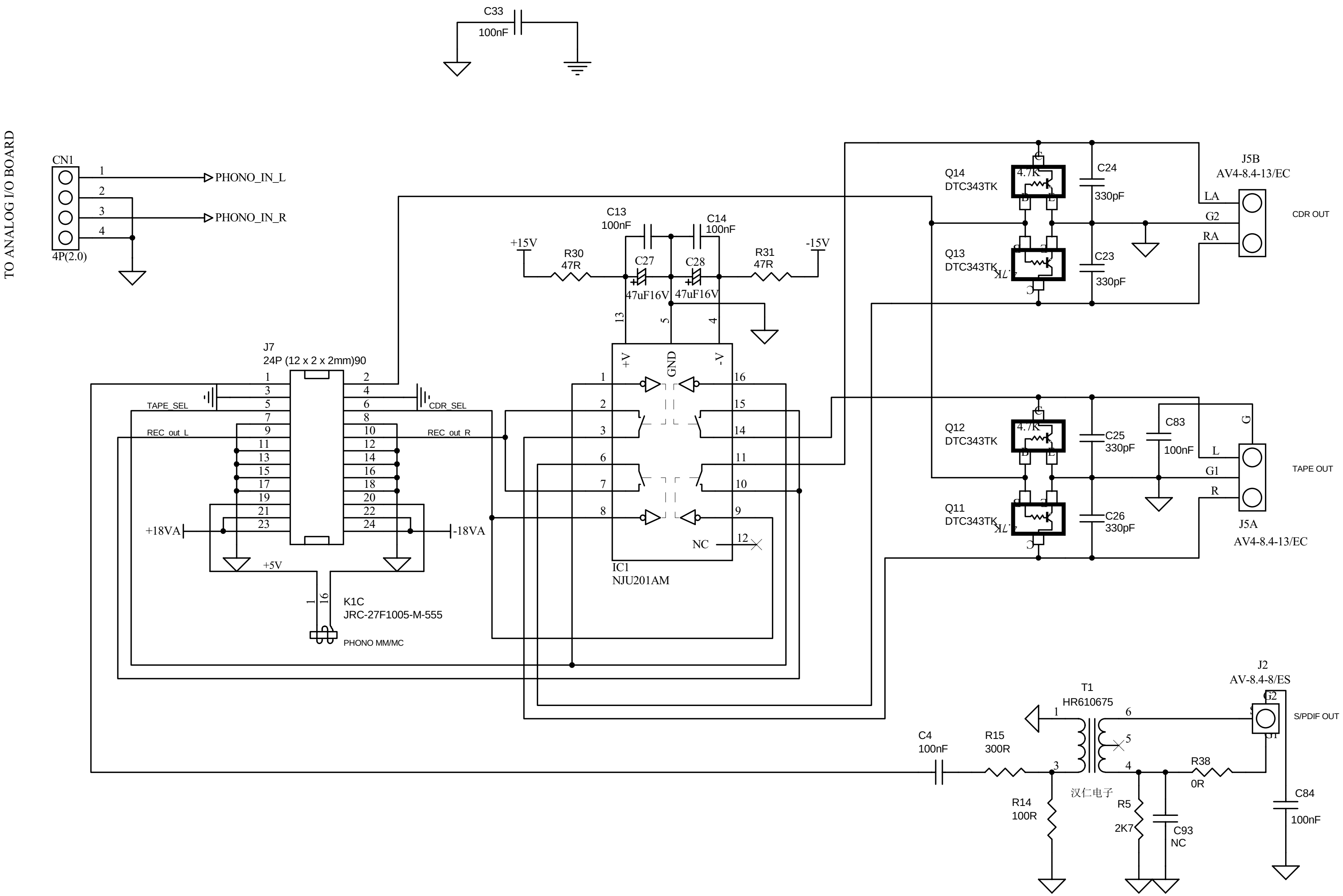
J4
2x4P2.0(90)
P[3] SPDIF_RECORD
SRC_AESOUT P[3]
P[1,3] CLK_24MHZ
BITCLK_ADC P[1]
P[1] SDATA_ADC
LRCLK_ADC P[1]
CDR_OUT SEL
J5
2x13P2.0(90)
INT_AK4683 P[3]
P[1] ANALOG IN_L
ANALOG IN_R P[1]
P[3] REC_out_L
REC_out_R P[3]
P[1,3] IN_L
IN_R P[1,3]
P[4] NJU7313_SCK
NJU7313_SDO P[4]
+3.3V
+5V
NJU7313_CS P[4]
+15VA
-15VA
L3
FB-0805
C63
100nF
C121
47uF/16V
U9
PCA9555
R51
10K
R55
10K
SCL_5V P[3]
SDA_5V P[3]
A0 A1 A2 SCL SDA INT VDD VSS
I/O0 I/O1 I/O2 I/O3 I/O4 I/O5 I/O6 I/O7
I/O10 I/O11 I/O12 I/O13 I/O14 I/O15 I/O16 I/O17
OVFL_CS5361 P[1]
R59 2K4
R57 2K4
HPF_CS5361 P[1]
RST_CS5361 P[1]
RST_AK4683# P[3]
R54 10K
R58 3K9
R60 3K9
D1 BAS16 K1C JRC-27F1005-M-555 RL_PROCESSOR
D2 BAS16 K2C JRC-27F1005-M-555 RL_CD
D3 BAS16 K3C JRC-27F1005-M-555 RL_TUNER
D4 BAS16 K4C JRC-27F1005-M-555 RL_CDR
D5 BAS16 K5C JRC-27F1005-M-555 RL_TAPE
D6 BAS16 K6C JRC-27F1005-M-555 RL_AUX
D7 BAS16 K7C JRC-27F1005-M-555 RL_TV
D8 BAS16 K8C JRC-27F1005-M-555 RL_PHONO
D9 BAS16 K9C JRC-27F1005-M-555 RL_XLR

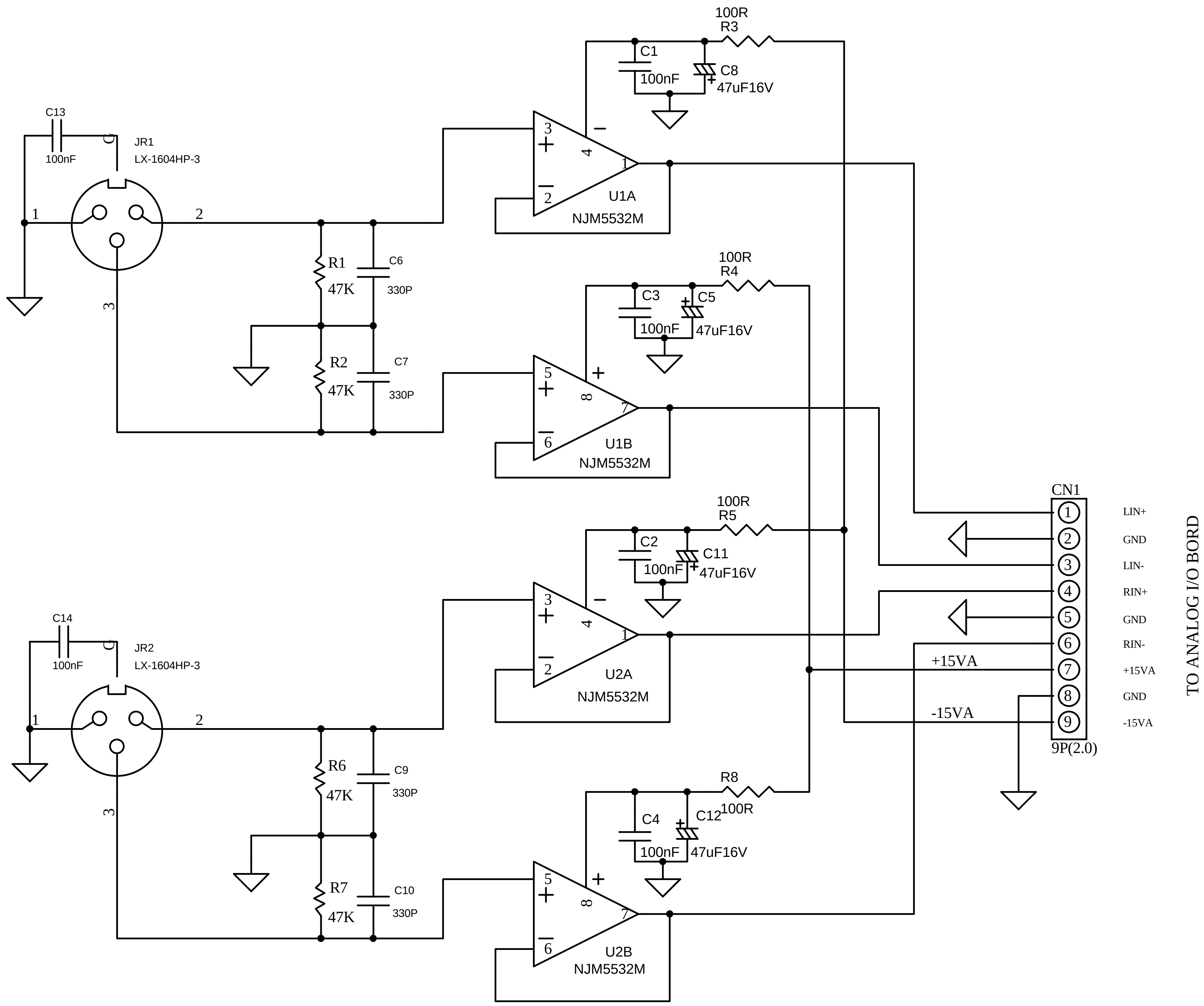


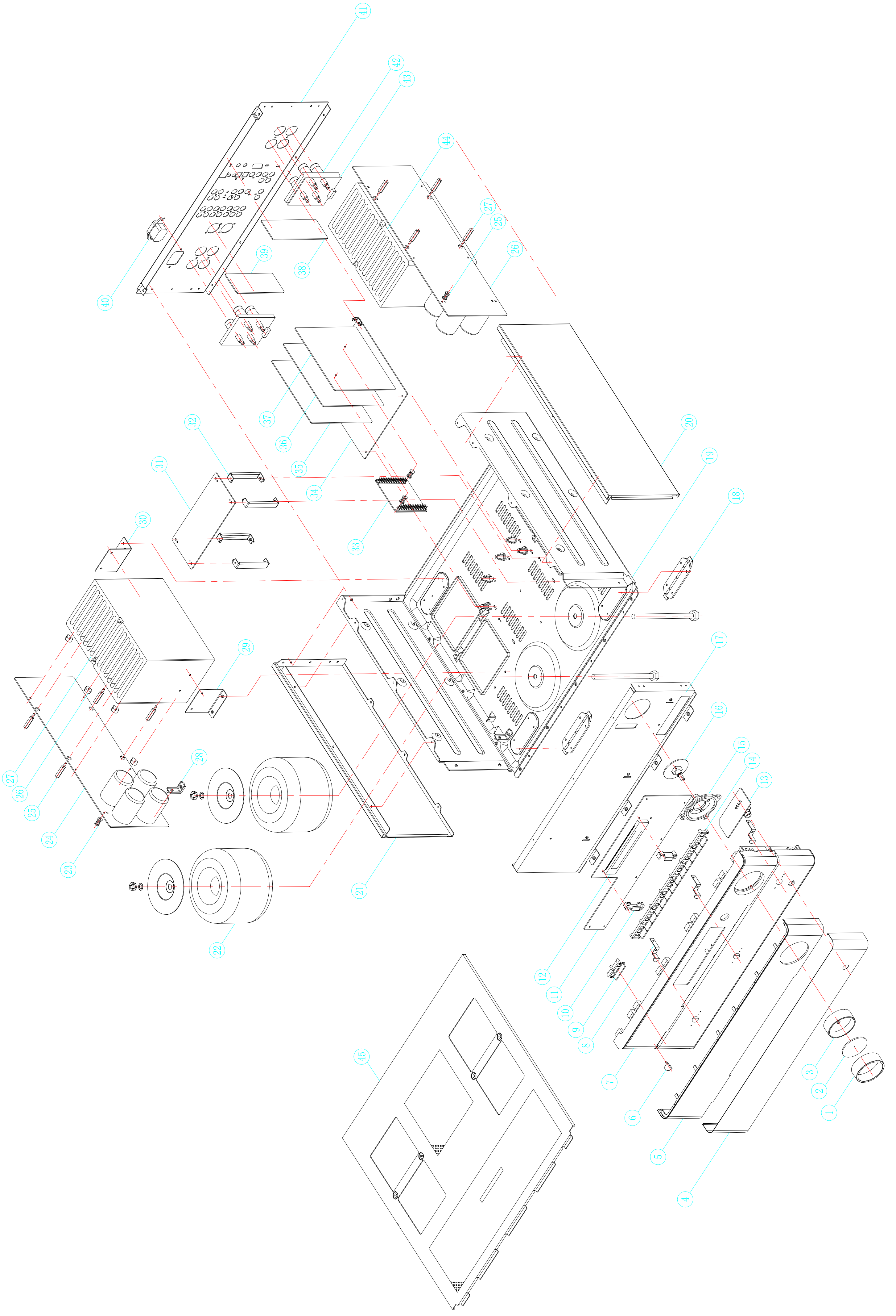

IC2
NJU7313AM
P[1] CD_in_L
P[1] Tuner_in_L
P[1] Aux_in_L
P[1] CDR_in_L
P[1] Tape_in_L
P[1] TV_in_L
P[3] PHONO_L
P[3] XLR_L
Level Shifter
Latch Circuit
Latch Circuit
Level Shifter
Control Circuit
CD_in_R P[1]
Tuner_in_R P[1]
Aux_in_R P[1]
CDR_in_R P[1]
Tape_in_R P[1]
TV_in_R P[1]
PHONO_R P[3]
XLR_R P[3]
DATA
CLK
ST
NJU7313_SDO P[2]
NJU7313_SCK P[2]
NJU7313_CS P[2]
VDD
VSS
VEE
C30 100pF
C66 100pF
C58 100pF
C65 100nF
C57 100nF
C64 100uF16V
C56 100uF16V
+15VA
-15VA
FB-0805 L5
FB-0805 L6
-15VA
R144 100R
C114 47uF16V
C62 100nF
C25
R64 47K1%
R_IN1 P[3]
U8A NJM2068
10uF/50V
R78 330K
R7 NC
R15 1K1%
C102 3.3nFM
+15VA
R146 100R
C61 100nF
C117 47uF16V
C8
R65 47K1%
L_IN1 P[3]
U8B NJM2068
10uF/50V
R88 330K
R14 NC
R16 1K1%
C103 3.3nFM


IN_MM_L
+12VAL
R29
10R
C12
220uF/16V
R19
4K7 1%
R28
560R1%
C11
10uF/50V
Q8
2SC3324
R13
10R1%
Q4
2SA1312
R10
22R1%
R3
10R1%
C3
10nF
IN_MC_L
R4
47R1%
Q3
2SC3324
R12
22R1%
R11
10R1%
Q7
2SA1312
C9
220uF/16V
R18
4K7 1%
R25
560R1%
C10
10uF/50V
-12VAL
R26
10R
K1A
JRC-27F1005-M-555
R27
3K9
C34
10uF16V
R65
82K
R66
120K
R82
47R
C32
330pF
+15V
R69
10R
C18
220uF/16V
R107
2.7K1%
R106
2.7K1%
Q46
2SC3324
Q45
2SC3324
R85
330R1%
R84
330R1%
R83
7.5K1%
1mA
Q38
2SC3324
Q37
2SC3324
R68
1K1%
C22
100nF
R67
1K1%
C29
100uF16V
R63
1K1%
C21
100nF
R64
1K1%
Q35
2SA1312
Q36
2SA1312
1mA
R81
7.5K1%
R79
330R1%
R80
330R1%
Q43
2SA1312
Q44
2SA1312
R102
2.7K1%
R103
2.7K1%
C17
220uF/16V
R62
10R
-15V
Q50
2SC3324
R119
470R1%
C42
10pF
Q54
2SA1312
R120
120R1%
R121
470K
N1210X226KCTx5R+-5%
(NPO)
C41
22uF/ELCO
R129
0R
D2
LED rouge
R109
6.8K1%
C36
1pF
R105
1K1%
R104
1.5K1%
R149
6.8K1%
C77
470uF16V
R128
1M2
C50
4.7nFM
R131
39K
R142
2K2
R144
0
Q60
2SC3324
R145
39R
C49
680PFM
C60
1.8nFM
C78
NC
C59
180pFM
C80
NC
R127
1M2
R126
0R
R141
DNE
R143
DNE
R140
39R
R118
120R1%
Q53
2SC3324
Q49
2SA1312
R116
NC
Q59
2SA1312
R117
470R1%
C40
10pF
R151
1K
TP10
TESTPOINT
C63
2.7nF
R32
100K
C64
10uF16V
PHONO_IN_L
IC2
LM317EMP
+18VA
V IN
ADJ
V OUT
C86
100nF
C89
10uF/50V
C87
100nF
R34
220R
R36
2K4
C90
220uF/25V
+15V
R37
2K4
C91
220uF/25V
C82
100nF
10uF/50V
C88
C85
100nF
R35
220R
-18VA
-15V
IC3
LM337IMP
D8
BAS85
+12VAL
TP6
TESTPOINT
C69
10uF/50V
R153
330R
Q62
2sc3265
C74
330uF/25V
C70
1uF
C73
330uF/25V
C68
1uF
D10
BZV55/C12
C46
330uF/25V
C56
1uF
D4
BZV55/C12
C55
10uF/50V
R133
330R
Q56
2SA1298
C45
330uF/25V
C54
1uF
TP4
TESTPOINT
-12VAL
D6
BAS85




C33
100nF
TO ANALOG I/O BOARD
CN1
4P(2.0)
PHONO_IN_L
PHONO_IN_R
C13
100nF
C14
100nF
+15V
R30
47R
C27
47uF16V
C28
47uF16V
R31
47R
-15V
J7
24P (12 x 2 x 2mm)90
TAPE_SEL
CDR_SEL
REC_out_L
REC_out_R
+18VA
-18VA
+5V
K1C
JRC-27F1005-M-555
PHONO MM/MC
+V
GND
-V
NC
IC1
NJU201AM
Q14
DTC343TK
Q13
DTC343TK
C24
330pF
C23
330pF
4.7K
J5B
AV4-8.4-13/EC
LA
G2
RA
CDR OUT
Q12
DTC343TK
Q11
DTC343TK
C25
330pF
C26
330pF
C83
100nF
G
L
G1
R
TAPE OUT
J5A
AV4-8.4-13/EC
J2
AV-8.4-8/ES
S/PDIF OUT
T1
HR610675
汉仁电子
C4
100nF
R15
300R
R14
100R
R5
2K7
C93
NC
R38
0R
C84
100nF


C13
100nF
JR1
LX-1604HP-3
C14
100nF
JR2
LX-1604HP-3
R1
47K
C6
330P
R2
47K
C7
330P
R6
47K
C9
330P
R7
47K
C10
330P
100R
R3
C1
100nF
C8
47uF16V
U1A
NJM5532M
100R
R4
C3
100nF
C5
47uF16V
U1B
NJM5532M
100R
R5
C2
100nF
C11
47uF16V
U2A
NJM5532M
R8
100R
C4
100nF
C12
47uF16V
U2B
NJM5532M
CN1
LIN+
GND
LIN-
RIN+
GND
RIN-
+15VA
GND
-15VA
+15VA
-15VA
9P(2.0)
TO ANALOG I/O BORD


1
2
3
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990 Explode List

NO	PART.NO	DESCRIPTION	QTY
1	6549 101A 0000	VOLUME KNOB COVER	1
2	7448 1020 0000	VOLUME KNOB LENS	1
3	7548 101C 0000	VOLUME PASTEM	1
4	6049 101E 0000	AL PANEL	1
5	7749 101A 0000	DISPLAY LENS	1
6	7448 103A 0000	STANDY LENS	1
7	7049 101D 0000	PASTEM PANEL	1
8	5548 103A 0000	EARTHING CUPREM	3
9	7348 101A 0000	POWER KNOB	1
10	7549 101A 0000	DISPLAY BRACKET	2
11	0099 1011 0000	DISPLAY PCB	1
12	1521 6151 0101	DISPLAY	1
13	0099 1210 000B	PHONE BOARD	1
14	7349 101A 0000	FUNCTION KNOB	2
15	7549 102B 0000	LAMPSHADE	1
16	0099 1191 0000	VOL PCB	1
17	5349 104D 0000	SUBPANEL	1
18	7948 1010 0000	FOOT	4
19	6249 101F 0000	BOTTOM COVER	1
20	6449 102A 0000	RIGHT SIDE PANEL	1
21	6449 101A 0000	LEFT SIDE PANEL	1
22	4090 1015 0000	TOROIDAL TRANSFORMER	2
23	7900 0040 0000	PASTEM PILLAR H=14	2
24	0099 1070 0000	POWER PCB	2
25	5349 1060 0000	BOLT	8
26	7900 0070 0000	PASTEM PILLAR H=5	8
27	5149 105D 0000	LEFT HEATSINK	1
28	5349 101A 0000	PCB BRACKET	2
29	5349 102A 0000	HEATSINK FRONT BRACKET	2
30	5349 103A 0000	HEATSINK REAR BRACKET	2
31	0099 1121 0000	RELAY PCB	1
32	5349 105A 0000	RELAY PCB BRACKET	4
33	0099 1280 0000	DSP PCB	1
34	0099 1290 000D	PREAMP MAIN PCB	1
35	0099 1510 0000	I / OPCB	1
36	0099 1210 0000	PHONO PCB	1
37	0099 1160 0000	DIGITAL PCB	1
38	0099 1171 0000	PHONE	1
39	0099 1031 0000	IR PCB	1
40	3103 1202 0952	AC SOCKET	1
41	6349 101E 0000	BACK COVER	1
42	7548 1050 0000	SPEAKER BRACKET	2
43	0099 1321 000A	SPEAKER JOINT BOARD	2
44	5149 106D 0000	RIGHT HEATSINK	1

Digital BOARD PART LIST

P/N:0099-1160-0000

Used	Part Type	Designator Description	Part number
===	===================================	=====================	==========
1	4.7pF/50V±5% X7R 0805 MLCC	C55	2103 5479 0140
2	10pF/50V±5% X7R 0805 MLCC	C53 C54	2103 5100 0140
4	10uF/25V±10% Y5V 0805 MLCC	C1 C35 C66 C86	2103 5106 0140
2	220pF/50V±5% NPO 0805 MLCC	C76 C93	2103 5221 0140
4	220PF/100V±5% Mylar .CaP	C70 C81 C87 C99	2217 3221 0243
2	330pF/50V±5% X7R 0805 MLCC	C10 C11	2103 5330 0140
4	1000PF/100V±5% Mylar .CaP	C71 C82 C88 C100	2217 3102 0243
4	3300PF/100V±5% Mylar .CaP	C14 C15 C25 C26	2217 3332 0243
4	0.1uF/10V±5% NPO 0805 MLCC	C115 C116 C117 C118	2103 6104 1645
59	0.1uF/50V±5% X7R 0805 MLCC	C2 C3 C5 C6 C8 C18 C19 C21 C22 C23 C24 C28 C29 C32 C33 C34 C36 C37 C38 C39 C40 C41 C42 C43 C44 C45 C46 C47 C49 C51 C56 C57 C59 C61 C62 C65 C67 C69 C72 C73 C74 C75 C79 C80 C83 C84 C89 C90 C91 C92 C95 C97 C98 C101 C102 C105 C112 C113 C114	2103 5104 0140
2	1uF/50V±5%(Metalized polyester	C78 C96	2207 4105 0100
2	47uF/16V(Tan) CS45	C77 C94	2340 0310 0009
7	47uF/16V±20% E.CaP	C64 C68 C85 C103 C104 C106 C107	2340 0310 1015
20	47uF/25V±20% E.CaP	C4 C7 C9 C12 C13 C16 C27 C30 C31 C48 C50 C58 C60 C63 C108 109 C110 C111 C119 C120	2340 0410 1015
10	FB(0805)1210(TB20129Z601)EMI 100MHz 600R	FB1 FB2 FB3 FB4 FB5 FB6 FB7 FB8 FB9 FB10	1852 0120 9100
1	AV2-8.4-14/EC	J2	2910 2322 2141
1	AV4-8.4-13/EC	J1	2910 4211 2131
2	CKX-3.5-12A 3.5mm DC JACK	J3 J7	2801 1335 1203
1	2*4P2.0(90)Twin-Row Pin	J5	3102 1008 4802
1	2*14P2.0(90)Twin-Row Pin	J6	3102 1028 4802
1	RJ45 10P8C	J4	2807 0345 0000
3	22uH --1812	L1 L2 L3	1882 2019 0101
4	2SA1035R SC-59 Panasonic	Q5 Q6 Q7 Q8	1111 0350 1101
1	BSS123 SOT23 (Fairchild)	Q4	1180 1230 1011
2	DTC343TK SOT23 ROHM	Q1 Q2	1150 3430 0341
1	SS8550 SOT23	Q3	1310 8008 5502
1	ICS83905AGT TSS0P16 ICS	U13	1083 9052 0615
2	JSR1162-002	U1 U2	1341 1621 0100
1	LL4148	D1	1301 4148 1500
1	NJM2068M DMP8 JRC	U3	1031 2068 1300
2	OP275GS SOIC8 (Analog Device)	U17 U22	1000 2750 0413
2	OPA2134UA SO-8 (Burr-brown)	U16 U21	1002 1340 0738
1	PCA9554APW TSSOP16 PHILIPS	U20	1009 5540 4915
1	SRC4392IPFBT TQFP48 ICS	U9	1004 3920 0726
1	XWM8740EDS SSOP28 (Wolfson)	U12	1008 7400 6714
1	(2*16P2.54)*2 Twin-Row Socket(180)	U18	3102 1016 5802

2	74HC4052D S016 PHILIPS	U6 U7	1004 0520 4913
2	74LCX125MTC TSSOP14 ST	U4 U5	1074 1250 1915
1	74LCX139TTR TSSOP16	U10	1074 1392 0815
2	AD1955ARS SSOP28 (Analog Device)	U19 U23	1001 9550 0414
1	AMS1117-1.8 SOT-223 AMS	U8	1011 7180 0156
1	AMS1117-3.3 SOT-223 AMS	U15	1011 7330 0128
1	AMS1117-5.0 SOT-223 AMS	U11	1011 7500 0128
1	0R±5% 0805	R14	2401 8200 0400
5	1K±5% 0805 film capacitor) MKS2 WIMA	R60 R81 R91 R99 R116	2401 8210 2400
4	2.2K±5% 0805	R80 R90 R98 R115	2401 8222 2400
14	2.7K±5% 0805	R79 R82 R19 R21 R24 R25 R86 R89 R93 R97 R10(	2401 8227 2400
		R104 R114 R118	
4	3.3K±5% 0805	R84 R94 R102 R119	2401 8233 2400
4	3K±5% 0805	R15 R18 R30 R33	2401 0823 0204
12	10K±5% 0805	R61 R71 R78 R106 R107 R108 R109 R110 R112	2401 8210 3400
		R113 R122 R123	
6	10R±5% 0805	R6 R7 R8 R9 R34 R37	2401 8210 0400
2	22K±5% 0805	R87 R105	2401 8222 3400
10	24K±5% 0805	R3 R4 R38 R41 R42 R45 R47 R50 R51 R54	2401 0824 0204
6	27R±5% 0805	R62 R63 R66 R67 R68 R69	2401 8227 0400
17	47K±5% 0805	R16 R17 R31 R32 R39 R40 R43 R44 R46 R48 R49	2401 8247 3400
		R52 R53 R83 R92 R101 R117	
19	47R±5% 0805	R1 R2 R23 R26 R36 R55 R56 R57 R58 R59 R64	2401 8247 0400
		R65 R70 R72 R73 R74 R75 R76 R77	
2	75R±5% 0805	R20 R22	2401 8275 0400
3	100R±5% 0805	R12 R27 R35	2401 8210 1400
1	150R±5% 0805	R28	2401 8215 1400
1	300R±5% 0805	R29	2401 8230 1400
2	330R±5% 0805	R96 R121	2401 8233 1400
2	470R±5% 0805	R10 R11	2401 8247 1400
2	560R±5% 0805	R88 R111	2401 8256 1400
4	680R±5% 0805	R85 R95 R103 R120	2401 8268 1400
1	FSMD010-1206 PTC	PTC1	2410 0901 0205
4	HR610675 Wideband RF transformer (Hanrun)	T1 T2 T3 T4	1061 0672 1801
1	24.576MHz(CS5032)	Y2	2705 2457 6026

PHONES BOARD PART LIST

P/N:0099-1171-0000

Used	Part Type	Designator Description	Part number
===	===================================	=====================	==========
1	CK-6.35-02 JACK	CK1	2822 2200 0100
1	4P(2.0mm)SOCKET	CN13	3100 4040 0200
1	5P2.5mm SOCKET	CN12	3100 5050 0200
3	10uF/16V±20% E.CAP	C38 C40 C41	2310 0310 1015
1	47PF/50V±5% X7R 0603 MLCC	C31	2103 5470 0130
2	100uF/25V±20% E.CAP	C9 C10	2311 0410 1015
7	0.1uF/50V±5% X7R 0603 MLCC	C1 C2 C3 C5 C35 C36 C42	2156 1040 0130
1	150PF/50V±5% X7R 0603 MLCC	C32	2103 5151 0130
2	330PF/50V±5% X7R 0603 MLCC	C29 C30	2103 5331 0130
1	470PF/50V±5% X7R 0603 MLCC	C7	2103 5471 0130
1	0.047uF/50V±5% X7R 0603 MLCC	C4	2115 6473 0130

1	IN4148	D4	1311 1414 8000
1	NJM2068M SOIC8 JRC	IC5	1031 2068 1300
1	TPA6120A2 DWP-20 (Texas lnstrument)	IC4	1061 2020 6138
1	1.65K±1% 0603	R3	2403 1216 5203
10	1K±5% 0603	R7 R8 R9 R10 R11 R12 R13 R14 R25 R26	2401 1221 0203
1	2.2K±5% 0603	R32	2401 1222 2203
4	10K±5% 0603	R4 R18 R23 R24	2401 1221 0303
3	10R±5% 0603	R1 R2 R15	2401 1221 0003
1	27K±5% 0603	R31	2401 1222 7303
3	47K±5% 0603	R17 R19 R20	2401 1224 7303
2	100R±5% 0603	R29 R30	2401 1221 0103
1	100k±5% 0603	R28	2401 1221 0403
1	200R±5% 0603	R22	2401 1222 0103
1	JRC-27F/012-M(555)	RELAY1	4712 2027 0006
1	2SC2120Y TO-92 TOSHIBA	Q2	1132 1200 0162

HK990 PART LIST

L&R Power amplifier board

PN : 0099-1070-0000

Used	Part Type	Designator Description	Part number
===	===================================	=====================	==========
6	47nF/100V	C1 C6 C9 C10 C16 C17	2217 3473 0243
2	220uF/100V	C2 C18	2321 0810 5093
4	6800uF/80V	C3 C4 C12 C13	2362 1410 9093
4	10nF/250V	C5 C8 C14 C15	2223 3103 0400
2	1000uF/100V	C11 C7	2312 0810 7073
6	1uF/1206	C19 C20 C21 C22 C32 C34	2103 5105 0150
3	47nF/1206	C23 C24 C35	2115 5473 0150
1	270pF(NPO)5%/1206	C25	2103 5271 0155
2	47nF(Mylar)10%	C70 C26	2217 3473 0243
1	3.9pF(NPO)5%/1206	C27	2103 5399 0155
1	330pF/1206	C28	2103 5331 0150
2	10uF/1206	C30 C29	2103 5106 0150
2	47uF/1206	C31 C37	2115 5476 0150
1	2.2uF/1206	C33	2103 5225 0150
1	100nF/1206	C36	2103 5104 0150
4	MUR2020	D1 D2 D4 D5	1360 0202 0000
1	GBU8D	D3	1361 3000 0080
2	ZMM16ST(16V)	D6 D26	1301 6002 0100
6	BAS20	D7 D8 D14 D15 D25 D27	1340 0200 0100
14	DL4148	D9 D10 D11 D12 D13 D16 D17 D18 D19 D20 D21 D22 D23 D24	1310 4414 8000
12	WCB-403025-M382-T	FB1 FB2 FB3 FB4 FB5 FB6 FB7 FB8 FB9 FB10 FB11 FB12	1874 0302 5382
10	250 TERMINAL	JP1 JP2 JP3 JP4 JP5 JP6 JP7 JP8 JP9 JP10	2932 5000 2500
1	7P * 2mm	J1	3100 4070 0200
1	2.2uH	L1	1832 2000 0001
4	MJL1302A	Q1 Q2 Q4 Q5	1191 3020 1200

1	NJL1302D	Q3	1191 3020 1210
2	2SA1837	Q6 Q11	1111 8370 0130
1	MJE15033	Q7	1181 5033 1220
1	2SA1869	Q8	1111 8690 0100
2	2SC4793	Q9 Q18	1134 7930 0000
1	2SC4935	Q10	1134 9350 0120
4	MJL3281A	Q12 Q13 Q15 Q16	1183 2810 1200
1	NJL3281D	Q14	1193 2810 1210
1	MJE15032	Q17	1181 5032 1220
2	MJD253	Q20 Q38	1180 2530 1200
5	2SC3138	Q21 Q40 Q41 Q42 Q44	1133 1380 0121
7	2SA1312	Q22 Q23 Q24 Q26 Q27 Q28 Q29	1111 3120 0172
2	MJD243	Q39 Q25	1180 2430 1200
7	2SC3324	Q30 Q31 Q33 Q34 Q35 Q36 Q37	1133 3240 0717
1	BCP56-16	Q32	1185 6160 1400
1	2SA1255	Q43	1111 2550 0101
2	HF-115F-048-1ZS3B	RL3 RL4	4712 1150 0600
1	CWF51-104J-3951(100K)	RT1	1609 1070 0601
2	2K2 1W	R24 R1	2401 5222 2200
2	150R 3W	R2 R23	2413 0721 5108
3	22K 3W	R3 R13 R15	2413 0722 2310
2	10K 3W	R4 R16	2413 0721 0308
10	0.33R 5W	R5 R6 R7 R8 R9 R17 R18 R19 R20 R21	2413 1023 3808
1	5R6 1W	R10	2401 5225 6900
1	5R 5W	R11	2412 1025 0910
1	1R 5W	R12	2412 1021 0910
1	30K 3W	R14	2413 0723 0310
1	6K2 1/2W	R22	2413 0426 2211
10	10K/1206	R25 R30 R60 R61 R62 R78 R79 R82 R89 R94	2402 0911 0305
2	0.22R(RF) 2W	R26 R27	2410 0622 2815
6	1K/1206	R28 R42 R44 R58 R70 R90	2402 0911 0205
4	22K/1206	R29 R57 R59 R95	2402 0912 2205
2	1M/1206	R31 R32	2402 0911 0505
10	10R/1206	R33 R34 R35 R36 R37 R84 R85 R86 R87 R88	2402 0911 0005
5	4K3/1206	R38 R40 R41 R74 R83	2402 0914 3205
2	1K8/1206	R39 R75	2402 0911 8205
2	150R 1/4W 1%	R43 R76	2402 0311 5111
4	3K/1206	R45 R46 R69 R71	2401 0823 0204
2	39R/1206	R72 R47	2401 2239 0500
2	12K 1/4W 1%	R73 R48	2402 0311 2311
2	180R/1206	R66 R49	2402 0911 8105
4	330R/1206	R50 R51 R63 R64	2402 0913 3105
1	300R/1206	R52	2402 0913 0105
1	3224W-200R(BOURNS)	R53	4402 3324 2000
1	6K2/1206	R54	2402 0916 2205
1	10K 1/4W 1%	R55	2402 0311 0011

2	270R/1206	R65 R56	2402 0912 7105
3	390R/1206	R67 R80 R81	2402 0913 9105
1	82R/1206	R68	2402 0918 2005
1	68K/1206	R77	2402 0916 8305
3	33K/1206	R91 R92 R93	2402 0913 3305
2	2K4 /2W	R96 R97	2413 0622 4213
2	PC817A	U2 U1	1000 8170 5501
1	OPA2134UA	U3	1002 1340 0738
1	TL061CD	U4	1000 0610 6138

Preamp PART LIST

P/N:0099-1290-0000

Used	Part Type	Designator Description	Part number
===	===================================	=====================	==========
1	3P(2.0mm)Socket	CN1	3100 4030 0200
2	2200PF/50V±5% X7R 0805 MLCC	C17 C19	2103 5220 0140
2	4700uF/16V±20% E.CAP	C63 C72	2342 3106 6000
2	4700uF/25V±20% E.CAP	C62 C71	2342 4105 5000
1	10UF/16V±20% E.CAP	C58	2310 0310 1015
11	10UF/50V±20% E.CAP	C10 C11 C12 C24 C30 C38 C40 C45 C55 C64 C74	2310 0610 1015
6	47uF/16V±20% E.CAP	C3 C6 C9 C13 C31 C34	2340 0310 1015
2	47uF/25V±20% E.CAP	C41 C73	2340 0410 1015
3	100PF/50V±5% X7R 0805 MLCC	C43 C44 C48	2103 5101 0140
24	0.1uF/50V±5% X7R 0805 MLCC	C1 C2 C4 C5 C14 C15 C16 C18 C22 C25 C27 C29 C32 C35 C37 C51 C57 C65 C68 C69 C75 C77 C81 C82	2103 5104 0140
4	100uF/16V(For audio)±20% E.CAP	C49 C52 C53 C56	2311 0310 1025
3	100UF/16V±20% E.CAP	C42 C46 C47	2311 0310 1015
2	220PF/100V±5% Mylar.CaP	C7 C8	2203 2221 0244
4	220uF/10V±20% E.CAP	C36 C39 C20 C23	2321 0410 1015
4	220uF/25V±20% E.CAP	C21 C26 C28 C33	2321 0410 1015
2	470uF/35V±20% E.CAP	C50 C54	2341 0510 3015
2	30BQ040TRPbF(SMC IRF)	D2 D4	1310 0030 0401
1	BAS16 SOT23	D5	1340 0161 0100
2	GBU806 Rrectifying Diode	D6 D7	1361 3000 0806
7	FB(0805) 1210(TB20129Z601)EMI 100MHz 600R	FB1 FB2 FB3 FB4 FB5 FB6 FB7	1852 0120 9100
2	2*4P2.0(180)Twin-Row Socket	J4 J5	3107 0404 6602
1	2*13P2.0(180)Twin-Row Socket	J6	3102 0926 6802
1	2*12P2.0(180)Twin-Row Socket	J7	3107 0412 6662
1	2*14P2.0(180)Twin-Row Socket	J8	3102 0928 6802
1	6P 2.5mm(180)Single Row pin	J9	3106 0506 0802
1	4P(2.0mm)Socket	J14	3100 4040 0200
2	5P(2.5mm)Socket	J11 J13	3100 5050 0200
1	6P(2.0mm)Socket	J12	3100 4060 0200
2	7P(2.0mm)Socket	J2 J3	3100 4070 0200
1	AV2-8.4-14/EC	JK1	2910 2191 0200
1	L7805CV TO-220	IC1	1007 8050 7027
1	AMS1085CT TO-220 AMS	IC2	1001 1085 0800
3	JRC-27F/005-M(555)	K1 K3 K4	4712 0000 2700
1	TIP31C TO-220 FAIRCHILD	Q2	1110 0310 6000
1	TIP32C TO-220 FAIRCHILD	Q7	1110 0320 6000
4	2SA1035R (SC-59 Panasonic)	Q8 Q9 Q18 Q19	1111 0350 1101

10	2SC2406R (SC-59 Panasonic)	Q1 Q3 Q4 Q5 Q6 Q12 Q13 Q14 Q15 Q17	1132 4060 5000
2	BSS123 SOT23	Q10 Q20	1180 1230 1011
2	1.3K±5% 0805	R5 R7	2401 8221 3204
6	1K±5% 0805	R19 R20 R38 R50 R51 R59	2401 8210 2400
3	RF0.22R/0.5W±5%	R40 R41 R42	2406 0422 2815
2	2.4K±5% 0805	R30 R37	2401 8224 2400
2	2.7K±5% 0805	R54 R61	2401 8227 2400
13	4.7K±5% 0805	R29 R32 R33 R34 R39 R47 R52 R56 R57 R58 R60 R62 R90	2401 8247 2400
2	5.6R±5% 0805	R23 R24	2401 8256 9400
32	10K±5% 0805	R9 R10 R27 R48 R49 R53 R65 R66 R69 R70 R71 R72 R73 R74 R75 R76 R80 R83 R84 R85 R87 R88 R89 R91 R92 R94 R98 R99 R103 R104 R106 R108	2401 8210 3400
4	22K±5% 0805	R67 R68 R95 R96	2401 8222 3400
4	27R±5% 0805	R78 R79 R81 R82	2401 8227 0400
6	47K±5% 0805	R15 R16 R64 R77 R86 R97	2401 8247 3400
2	75R±5% 0805	R13 R14	2401 8275 0400
6	100K±5% 0805	R45 R46 R101 R102 R105 R107	2401 8210 4400
13	100R±5% 0805	R1 R2 R3 R8 R11 R12 R35 R36 R43 R44 R55 R63 R100	2401 8210 1400
2	150R±5% 0805	R17 R25	2401 8215 1400
2	220R±5% 0805	R28 R31	2401 8222 1400
1	412R±1% 0805	R21	2414 0841 2104
1	470R±5% 0805	R93	2401 8247 1400
2	680R±5% 0805	R18 R26	2401 8268 1400
1	680R±1% 0805	R22	2414 0868 0104
2	910R±5% 0805	R4 R6	2401 8291 1400
1	TSAB-3 (H=5mm) PUSHBUTTON	SW1	4502 4000 3100
2	AD825AR SOIC8 (Analog Device)	U2 U3	1000 8250 0438
1	LM317EMP SOT223 (National Semiconductor)	U5	1043 0317 0861
1	LM317T-ADJ TO-220 (National Semiconductor)	U6	1000 3170 5427
1	LM337IMP SOT223 (National Semiconductor)	U8	1000 3370 4361
1	LM337T-ADJ TO-220 (National Semiconductor)	U9	1000 3370 4349
1	NJW1159M DMP16 JRC	U4	1001 1590 3130
1	PIC18F66J10 TQFP64 (Microchip Technology)	U17	1001 8662 1326
1	ULN2003AD(SOL160-P-150-1.27) TEXAS	U15	1002 0030 6138
2	7P PLUG TO PLUG 2468#26X5C＆2547#28X1C 2.0 L=180MM		3307 0504 0282
1	6P PLUG TO PHOUSING 2468#26X6C 2.0 L=380MM		3306 0504 0385
1	5P PLUG TO PLUG 2468#26X5C 2.5 L=300MM		3304 0505 0302
1	4P PLUG TO PLUG2468#26X4C 2.0 L=60MM		3304 0504 0064
1	3P PLUG TO HOUSING2468#26X3C 2.0 L=60MM		3303 0504 0063

HK990 PART LIST

P/N:0099-1011-0000

Used	Part Type	Designator Description	Part number
2	30pF/50V±10%	C18 C19	2115 6300 0123
4	0.1uF/50V±10%	C1 C3 C5 C11	2115 6104 0123
4	0.1uF/50V±5% 0603	C2 C9 C36 C38	2156 1040 0130
2	10uF/10V±20% E.CAP	C7 C50	2310 0210 1015
1	10uF/16V±20% E.CAP	C16	2310 0310 1015

2	47uF/10V±20% E.CAP	C14 C17	2340 0210 0015
2	100uF/16V±20% E.CAP	C12 C37	2311 0310 1015
1	7P PLUG TO HOUSING2468#26X7C 2.0 L=300MM	CN1	3307 0704 0335
1	4P HOUSING TO HOUSING2468#26X4C 2.0 L=60MM	CN4	3304 0504 0064
1	5P PLUG TO HOUSING2468#26X7C 2.0 L=300MM	CN13	3304 0505 0302
1	6P PLUG TO PHOUSING 2468#26X6C 2.0 L=380MM	CN2	3306 0504 0385
1	1*6P(2.5)(90°)	CN14	3100 0506 0802
1	IN4148	D4	1311 1414 8000
1	AT24C02 SOP8 (ATMEL)	IC1	1002 4010 6620
1	LD1117S33 SOT-223 (ST)	IC2	1054 1117 2800
1	PIC18F66J10 TQFP64 (Microchip Technology)	IC3	1001 8662 1326
1	KS-803LM(90°)	IR1	1304 0008 0300
1	LED (Y&W)	LED1	1402 1203 0015
14	TSHC-78A-5.0	K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 K14	4502 4007 8100
3	2SC2406 SC-59 (PANASONIC)	Q7 Q8 Q9	1132 4060 5000
3	2SC1815 TO-92 (TOSHIBA)	Q2 Q4 Q6	1131 8150 0172
1	2SC2458 TO-92 (TOSHIBA)	Q10	1132 4580 0172
1	2SA950 TO-92 (TOSHIBA)	Q18	1110 9500 0162
1	1MΩ1/8W±5%	R7	2401 0221 0511
1	4.7KΩ1/8W±5%	R16	2401 0224 7211
25	10KΩ1/8W±5%	R4 R5 R15 R19 R29 R31 R32 R33 R34 R35 R36 R37 R38 R40 R41 R44 R45 R46 R47 R57 R58 R59 R60 R61 R62	2401 0221 0311
5	10KΩ±5% 0603	R39 R42 R65 R67 R85	2401 1221 0303
3	4.7KΩ±5% 0603	R43 R66 R68	2401 1224 7203
1	27KΩ±5% 0603	R6	2401 1222 7303
2	10Ω1/8W±5%	R1 R2	2401 0221 0011
2	27Ω1/8W±5%	R30 R49	2401 0222 7011
1	27KΩ1/8W±5%	R6	2401 0222 7311
2	39KΩ1/8W±5%	R54 R55	2401 0223 9311
1	47Ω1/8W±5%	R56	2401 0224 7011
2	100KΩ1/8W±5%	R52 R53	2401 0221 0411
3	100Ω1/8W±5%	R3 R50 R51	2401 0221 0111
1	470Ω1/8W±5%	R21	2401 0224 7111
1	560Ω1/8W±5%	R20	2401 0225 6111
1	16-BT-151GINK	VF1	1521 6151 0101
1	24.576MHZ(HC-49S)	Z1	2705 2457 6026

HK990 PART LIST

DSP-PCB P/N:0099-1280-0000

Used	Part Type	Designator Description	Part number
===	==================================	=====================	==========
41	0.1UF/50V±5% 0603	C2 C3 C4 C5 C6 C7 C8 C9 C12 C13 C16 C17 C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C33 C34 C35 C36 C37 C38 C39 C40 C41 C42 C43 C44 C45 C46 C47 C48	2156 1040 0130
1	10UF/6.3V±20% SMDE.CAP 4X5.4	C1	2310 0100 0138
1	22UF/6.3V ±20% SMDE.CAP 5X5.4	C10	2320 0121 1138
1	47UF/6.3V ±20% SMDE.CAP 5X5.4	C11	2340 0111 1138
3	100UF/6.3V ±20% SMDE.CAP 6.3X5.4	C14 C15 C18	2311 0110 2138

2	2*16P(2.54)(180°)	J1 J2	3113 0516 6872
1	2*7P(2.54)(180°)	J3	3102 1007 5802
2	FB---0805	L1 L3	1852 0120 9100
1	2.2K---0603	R1	2401 1222 2203
31	33Ω---0603	R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R16 R17 R18 R19 R20 R21 R22 R23 R29 R30 R31 R32 R33 R34 R35 R36 R37	2401 1223 3003
6	3.3K±5% 0603	R24 R25 R26 R27 R28 R44	2401 1223 3203
2	1K±5% 0603	R38 R41	2401 1221 0203
2	4.7K±5% 0603	R39 R40	2401 1224 7203
1	SN74LVC823APW TSSOP24 (TI)	U1	1074 8230 6115
1	TMS320D708E001BRFP LPQF-144 (TI)	U2	1032 0700 6158
1	HY57V64162OETP-7 TSOP54 (HNNIX)	U3	1057 6410 8942
1	S29AL016D70TFI02 TSOP48 (SPANSION)	U4	1029 0162 0742
1	FAN1112S SOT-223 (FAIRCHILD)	U5	1011 1200 1961
1	DS1818 SOT-23 (DALLAS)	U6	1001 8180 1356
1	NC7WZ07P6X_NL SC-70 (FAIRCHILD)	U7	1000 7070 1965

HK990 PART LIST

P/N:0099-1031-0000

Used	Part Type	Designator Description	Part number
===	===================================	=====================	==========
9	0.1uF/50V±10%	C4 C8 C15 C30 C33 C34 C35 C48 C49	2115 6104 0123
1	47uF/10V±20% E.CAP	C32	2340 0210 0015
1	100uF/10V±20% E.CAP	C31	2311 0210 1015
1	5P(2.0) SOCKET	CN12	3100 4050 0200
1	3P PLUG TO HOUSING2468#26X3C 2.0 L=150MM	CN15	3303 0504 0063
2	IN4148	D5 D6	1311 1414 8000
1	K1010(817) DIP4 (COSMO)	IC5	1022 8170 7012
1	MAX232 SOP16 (MAXIM)	IC8	1000 2320 3613
1	DB9	JK3	2806 0590 0000
2	CKX3.5-12A 3.5mm	JK1 JK2	2801 1335 1203
1	SK-22H03G6-RS	K16	4200 2200 0500
3	10uH	L1 L2 L3	1881 0002 0000
2	2SA1015 TO-92 (TOSHIBA)	Q5 Q17	1111 0510 0712
1	3.9KΩ1/8W±5%	R27	2401 0223 9211
1	10KΩ1/8W±5%	R87	2401 0221 0311
3	22KΩ1/8W±5%	R86 R88 R89	2401 0222 2311
1	47KΩ1/8W±5%	R24	2401 0224 7311
1	10Ω1/8W±5%	R26	2401 0221 0011
2	47Ω1/8W±5%	R22 R23	2401 0224 7011
1	75Ω1/8W±5%	R25	2401 0227 5011
1	270Ω1/8W±5%	R28	2401 0222 7111

HK990 PART LIST

P/N:0099-1121-0000

Used	Part Type	Designator Description	Part number
===	===================================	=====================	==========
2	DB101G	BL1	1361 3011 0100
1	220uF/10V±20% E.CAP	C24	2321 0210 2015
2	100uF/16V±20% E.CAP	C25 C53	2311 0310 1015

2	470uF/25V±20% E.CAP	C26	2341 0410 1015
5	0.1uF/50V±10%	C21 C22 C44 C46 C52	2115 6104 0123
1	47uF/50V±20% E.CAP	C47	2340 0610 1010
1	100uF/50V±20% E.CAP	C27	2311 0610 1015
2	100uF/63V±20% E.CAP	C28 C45	2311 0710 1015
1	0.1uF/275VAC(X2)	C23	2210 3104 0600
1	JY103M(X1/400V.Y2/300V)	C20	2210 3103 0600
4	2P(2.5) SOCKET	CN16 CN17 CN18 CN19	3100 5020 0200
4	3P(3.96) SOCKET	CN7 CN8 CN9 CN10	3100 0702 0050
1	7P(2.0) SOCHET	CN6	3100 4070 0200
1	7P(2.5) SOCKET	CN11	3100 5070 0200
1	IN4148	D2	1311 1414 8000
2	IN4001	D1 D3	1360 1400 1005
1	HZ7B2ST	DW1	1300 5660 0200
1	HZ38-3ST	DW2	1303 8002 0200
1	FUSE T5AL 250V	FH1	1601 0515 0120
2	KA7805 TO-220 (FAIRCHILD)	IC4 IC7	1019 7805 0800
1	2SC2120 TO-92 (TOSHIBA)	Q1	1132 1200 0162
1	2SC2235 TO-92 (TOSHIBA)	Q11	1132 2350 6000
1	2SC2458 TO-92 (TOSHIBA)	Q16	1132 4580 0172
1	2SA950 TO-92 (TOSHIBA)	Q15	1110 9500 0162
2	2SC2073 TO-220 (MOSPEC)	Q3 Q14	1132 0730 7000
2	2SC1815 TO-92 (TOSHIBA)	Q12 Q13	1131 8150 0172
1	1K1/8W±5%	R12	2401 0221 0211
3	1.2K1/8W±5%	R69 R73 R78	2401 0221 2211
2	4.7K1/8W±5%	R83 R91	2401 0224 7211
2	10K1/8W±5%	R74 R79	2401 0221 0311
2	12K1/8W±5%	R72 R77	2401 0221 2311
2	15K1/8W±5%	R71 R80	2401 0221 5311
3	22K1/8W±5%	R10 R82 R84	2401 0222 2311
2	220Ω1/8W±5%	R75 R76	2401 0222 2111
2	470Ω1/8W±5%	R70 R81	2401 0224 7111
1	100Ω1/8W±5%	R90	2401 0221 0111
1	2.2Ω0.5W±5%	R14	2406 4222 2900
1	RF11/4W±5%	R13	2406 3210 9000
1	RF0.221/4W±5%	R11	2406 0322 2815
1	JQX-115F(12V DC)	RAY1	4712 1211 5006
1	EI-28 Transformer	T1	4070 1285 0000
1	EI-57Transformer	T2	4090 1575 0003
2	Toroidal Transformer	T3 T4	4090 1015 0001
2	THERMISTANCE 02DSBJ WITH LEAD AND 2P2.5mm		1609 0282 0070
2	FAN A9225 M12S DC12V 0.24A		9105 2518 7242
2	FUSE HOLDER		1601 0001 0000
1	FUSE COVER		1608 0001 0000

HK990 PART LIST

P/N:0099-1191-0000

Used	Part Type	Designator Description	Part number
1	0.1uF/50V±10%	C10	2115 6104 0123
4	LED IL0445W31BOLG201	LED2 LED3 LED4 LED5	1402 0705 0006

4	220Ω1/8W±5%	R17 R18 R63 R64	2401 0222 2111
1	R122ECA-D1-19.5F-24-W	RV1	4401 2211 9524

HK990 PART LIST

Analog I/O-PCB P/N:0099-1510-0000

Used	Part Type	Designator Description	Part number
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23	47uF/16V--DIP	C24 C26 C27 C38 C53 C108 C109 C110 C111 C112 C113 C114 C115 C116 C117 C4 C11 C41 C44 C45 C100 C120 C121	2340 0310 1015
3	100uF/16V--DIP	C42 C56 C64	2311 0310 1015
1	1uF/25V--DIP	C96	2319 0410 1015
4	47uF/25V--DIP	C21 C36 C82 C91	2340 0410 1015
14	330pF/50V--C_0805	C71 C72 C73 C74 C77 C78 C79 C80 C84 C85 C86 C87 C88 C89	2103 5330 0140
2	2.2uF/50V--DIP(MKS2)	C13 C98	2207 4224 0100
7	10uF/50V--DIP	C1 C8 C25 C104 C105 C106 C107	2310 0610 1015
2	220pF/100V--DIP	C14 C28	2217 3221 0243
2	1000pF/100V--DIP	C22 C37	2217 3102 0243
6	3300pF/100V--DIP	C52 C59 C102 C103 C118 C119	2217 3332 0243
37	0.1uF/50V--C_0805	C2 C7 C9 C15 C16 C17 C19 C20 C23 C29 C31 C32 C33 C34 C40 C43 C49 C50 C57 C61 C62 C65 C68 C69 C70 C75 C81 C83 C90 C92 C93 C94 C99 C101 C122 C123 C124 C63	2103 5104 0140
2	100pF/50V(NPO)--C_0805	C47 C55	2103 5101 0145
7	100pF/50V--C_0805	C3 C10 C30 C35 C48 C58 C66	2103 5101 0140
2	1000pF/50V(NPO)--C_0805	C60 C67	2103 5102 0145
2	150pF/50V--C_0805	C39 C51	2103 5151 1400
2	0.01uF/50V--C_0805	C95 C97	2103 5103 0140
1	1uF/50V--C_0805	C5	2103 5105 0140
1	2.2uF/50V--C_0805	C12	2103 5225 0140
2	680pF/50V(NPO)--C_0805	C46 C54	2103 5681 0145
1	9P(2.0) --JACK	CN1	3100 4090 0200
1	4P(2.0) --JACK	CN2	3100 4040 0200
9	BAS16--SOT23	D1 D2 D3 D4 D5 D6 D7 D8 D9	1340 0161 0100
6	0R--R_0805	R45 R47 R49 R50 R72 R73	2401 8200 0400
2	1K1%--R_0805	R15 R16	2401 8110 2400
4	1K--R_0805	R27 R28 R107 R111	2401 8210 2400
2	1.78K1%--R_0805	R33 R46	2403 0817 8804
2	2K4--R_0805	R57 R59	2401 8224 2400
1	LD1117S5.0(SOT-223)	IC1	1011 1751 1428
1	NJU7313AM--SDMP30(JRC)	IC2	1007 3130 3160
2	AV4-8.4-13/EC--RCA JACK	J1 J2	2910 4011 0510
1	AV6-8.4-13/EC--RCA JACK	J3	2910 6011 2031
1	2x4P2.0(90) --JACK	J4	3102 1008 4802
1	2x13P2.0(90) --JACK	J5	3102 0926 7802

9	JRC-27F1005-M-555	K1 K2 K3 K4 K5 K6 K7 K8 K9	4712 2027 0006
5	FB--L_0805	L2 L3 L5 L6 L7	1852 0120 9100
2	3K9--R_0805	R58 R60	2401 8239 2400
2	5.1K1%--R_0805	R34 R48	2403 0815 1204
2	5.1R--R_0805	R13 R29	2401 0825 1904
2	7.5K1%--R_0805	R63 R66	2402 0817 5904
2	9.1K1%--R_0805	R37 R44	2403 0819 1204
18	10K1%--R_0805	R1 R2 R30 R32 R35 R38 R39 R42 R102 R103 R114 R115 R116 R117 R118 R119 R120 R121	2401 8110 3400
10	10K--R_0805	R36 R43 R69 R70 R26 R51 R54 R55 R62 R67	2401 8210 3400
1	12K1%--R_0805	R12	2402 0811 2304
2	18K1%--R_0805	R6 R11	2402 0811 8304
2	27K1%--R_0805	R4 R24	2402 0812 7304
4	47K1%--R_0805	R21 R64 R65 R113	2414 0847 1004
6	47K--R_0805	R17 R18 R19 R20 R31 R41	2401 8247 3400
1	47R/1W--DIP	R106	2401 0524 7012
1	47R--R_0805	R22	2401 8247 0400
14	68K--R_0805	R74 R75 R76 R77 R83 R84 R85 R86 R87 R94 R95 R96 R97 R104	2401 8268 3400
20	100R--R_0805	R8 R10 R79 R80 R82 R109 R137 R138 R139 R140 R141 R142 R143 R144 R145 R146 R147 R148 R149 R150	2401 8210 1400
2	220K--R_0805	R81 R110	2401 8222 4400
14	220R--R_0805	R89 R90 R91 R92 R93 R98 R99 R100 R101 R105 R122 R123 R124 R125	2401 8222 1400
2	330K--R_0805	R78 R88	2401 8233 4400
4	330R1%--R_0805	R5 R9 R23 R25	2402 0813 3104
2	360R--R_0805	R108 R112	2401 0823 6104
2	470K1%--R_0805	R3 R40	2401 8147 4400
2	680R--R_0805	R68 R71	2401 8268 1400
2	AD825AR--SOIC8(Analog Device)	U10 U12	1000 8250 0438
1	AK4683EQ--LQFP64(AKM)	U2	1004 6830 0526
1	CS5361--SOIC24	U4	1053 6121 4101
2	NJM2068M--DMP8(JRC)	U7 U8	1031 2068 1300
4	NJM5532M--DMP8(JRC)	U1 U3 U6 U11	1031 5532 1300
1	PCA9555--TSSOP24(Philips)	U9	1009 5550 4915

HK990 PART LIST

Phono-PCB P/N:0099-1210-0000

Used	Part Type	Designator Description	Part number
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2	47uF/16V--DIP	C27 C28	2340 0310 1015
15	0.1uF/50V--C_1206	C4 C13 C14 C19 C20 C21 C22 C33 C81 C82 C83 C84 C85 C86 C87	2103 5104 0150
2	100uF/16V--DIP	C29 C75	2311 0310 1015
2	2700pF/50V--C_1206	C62 C63	2115 5272 0150
2	1pF/50V--C_1206	C35 C36	2103 5109 0150

8	1uF/50V--C_1206	C51 C53 C54 C56 C65 C67 C68 C70	2103 5105 0150
2	1800pF/100V--DIP	C58 C60	2217 3182 0243
2	4700pF/100V--DIP	C48 C50	2217 3472 0243
1	4P(2.0)--JACK	CN1	3100 4040 0200
2	0.01uF/50V--R_1206	C2 C3	2103 5103 0150
4	10pF/50--C_1206	C37 C39 C40 C42	2103 5100 0150
4	10uF16V--DIP	C30 C34 C61 C64	2310 0310 1015
10	10uF/50V--DIP	C6 C7 C10 C11 C52 C55 C66 C69 C88 C89	2310 0610 1015
2	22uF/10V(ELCO)--C_1210	C38 C41	2103 6221 1620
2	180pF/100V--DIP	C57 C59	2217 2182 0200
8	220uF/16V--DIP	C5 C8 C9 C12 C15 C16 C17 C18	2321 0310 1015
2	220uF/25V--DIP	C90 C91	2321 0410 1015
2	470uF/16V--DIP	C76 C77	2341 0310 3025
6	330pF/50V--R_1206	C23 C24 C25 C26 C31 C32	2103 5331 0150
8	330uF/25V--DIP	C43 C44 C45 C46 C71 C72 C73 C74	2331 0410 1015
2	680pF/100V--DIP	C47 C49	2217 2681 0243
2	LED rouge--1206	D1 D2	1403 0100 0007
4	BAS85--SOD80C(PHILIPS)	D5 D6 D7 D8	1300 0850 0101
4	BZV55/C12(12V)--SMD	D3 D4 D9 D10	1301 2555 0100
1	LM317EMP--SOT223	IC2	1043 0317 0861
1	LM337IMP--SOT223	IC3	1000 3370 4361
1	NJU201AM--DMP16(JRC)	IC1	1000 2010 3160
1	24P (12 x 2 x 2mm)90--JACK	J7	3102 1024 4802
2	AV4-8.4-13/EC--JACK	J5 J8	2910 4011 0510
1	AV-8.4-8/ES--JACK	J2	2910 1321 1003
1	JRC-27F1005-M-555--Relay	K1	4712 0000 2700
2	2SA1298--SOT23(Toshiba)	Q55 Q56	1111 2980 0101
18	2SA1312--SOT23(Toshiba)	Q2 Q4 Q5 Q7 Q31 Q32 Q35 Q36 Q39 Q40 Q43 Q44 Q47 Q49 Q52 Q54 Q57 Q59	1111 3120 0172
18	2SC3324--SOT23(Toshiba)	Q1 Q3 Q6 Q8 Q33 Q34 Q37 Q38 Q41 Q42 Q45 Q46 Q48 Q50 Q51 Q53 Q58Q60	1133 3240 0717
2	2sc3265--SOT23(Toshiba)	Q61 Q62	1133 2650 0141
4	DTC343TK--SOT23(ROHM)	Q11 Q12 Q13 Q14	1150 3430 0341
7	0R--R_1206	R138 R144 R38 R122 R125 R126 R129	2401-0920-0005
2	1.5K1%--R_1206	R98 R104	2402 0911 5205
10	1K1%--R_1206	R55 R56 R59 R60 R63 R64 R67 R68 R99 R105	2402 0911 0205
2	1K--R_1206	R146 R151	2401 2210 2500
4	1M2--R_1206	R123 R124 R127 R128	2401 2212 5500
8	2.7K1%--R_1206	R96 R97 R100 R101 R102 R103 R106 R107	2402 0912 7005
2	2K2--R_1206	R136 R142	2401 2222 2500
2	2K4--R_1206	R36 R37	2401 2224 2500
1	2K7--R_1206	R5	2401 2227 2500
2	3K9--R1206	R22 R27	2401 2239 2500
4	4K7 1%--R_1206	R16 R17 R18 R19	2402 0914 7105
4	6.8K1%--R_1206	R33 R108 R109 R149	2402 0916 8205
4	7.5K1%--R_1206	R74 R76 R81 R83	2402 0917 5005

6	10R1%--R_1206	R1 R3 R7 R9 R11 R13	2402 0911 0305
8	10R--R_1206	R21 R24 R26 R29 R54 R61 R62 R69	2401 2210 0500
4	22R1%--R_1206	R6 R8 R10 R12	2402 0912 2005
2	39K--R_1206	R130 R131	2401 2239 3500
4	39R--R_1206	R134 R139 R140 R145	2401 2239 0500
2	47R1%--R_1206	R2 R4	2402 0914 7005
4	47R--R_1206	R30 R31 R75 R82	2401 2247 0500
2	82K--R_1206	R57 R65	2401 2282 3500
2	100K--R_1206	R32 R156	2401 2210 4500
1	100R--R_1206	R14	2401 2210 1500
2	120K--R_1206	R58 R66	2401 2212 4500
4	120R1%--R_1206	R112 R114 R118 R120	2402 0911 2005
2	220R--R_1206	R34 R35	2401 2222 1500
1	300R--R_1206	R15	2401 2230 1500
8	330R1%--R_1206	R72 R73 R77 R78 R79 R80 R84 R85	2402 0913 3105
4	330R--R_1206	R132 R133 R152 R153	2401 2233 1500
2	470K--R_1206	R115 R121	2401 2247 4500
4	470R1%--R_1206	R111 R113 R117 R119	2402 0914 7005
4	560R1%--R_1206	R20 R23 R25 R28	2402 0915 6005
1	HR610675--Wideband RF transformer	T1	1061 0672 1801
1	4P PLUG TO PLUG1533#28X2C 2.0 L=350MM 2.4GND		3604 6043 5032

HK990 PART LIST

Symmetric-PCB P/N:0099-1080-0000

Used	Part Type	Designator Description	Part number
6	0.1uF/50V--C_0805	C1 C2 C3 C4 C13 C14	2103 5104 0140
4	330pF/50V--C_0805	C6 C7 C9 C10	2103 5330 0140
4	47uF/16V--DIP	C5 C8 C11 C12	2340 0310 1015
1	9P(2.0)--JACK	CN1	3100 4090 0200
2	LX-1604HP-3--JACK	JR1 JR2	2990 3330 0320
4	47K--R_0805	R1 R2 R6 R7	2401 8247 3400
4	100R--R_0805	R3 R4 R5 R8	2401 8210 1400
2	NJM5532M--DMP8(JRC)	U1 U2	1031 5532 1300
1	9P PLUG TO PLUG 2547#28X4C&2468#26X3C 2.0 L=120mm 2.5GND1346		3309 0504 0574